# ACADEMIC REGULATIONS & CURRICULUM

**Applicable to the students admitted from the Academic Year 2019-2020**

# MECHANICAL ENGINEERING

**(B.Tech. Programme)**

## MAHARAJ VIJAYARAM GAJAPATHI RAJ COLLEGE OF ENGINEERING

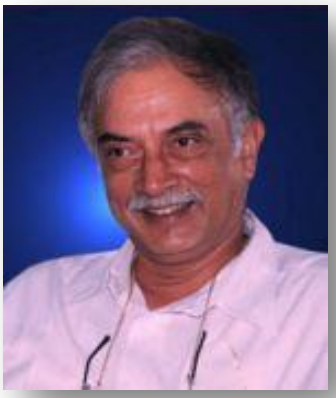
## (Autonomous)

(Approved by AICTE, New Delhi, and permanently affiliated to JNTUK, Kakinada)
Listed u/s 2(f) & 12(B) of UGC Act 1956.
Vijayaram Nagar Campus, Chintalavalasa,Vizianagaram-535005, Andhra Pradesh

# The visionaries

**Late Dr. P V G Raju**
Raja Saheb of Vizianagaram
Founder Chairman-MANSAS
Ex-Minister for Education and Health, Govt. of AP
Ex Member of Parliament

**Late Dr. P. Anand Gajapathi Raju**
**Ex-Chairman-MANSAS**
Ex-Minister for Education and Health
Govt. of AP
Ex Member of Parliament



**P. Ashok Gajapathi Raju**
**Chairman-MANSAS**
Ex-Union Minister for Civil Aviation,
Govt. of India
Ex-Minister for Finance, Govt. of AP

# Vision

Maharaj Vijayaram Gajapathi Raj College of Engineering strives to become a centre par excellence for technical education where aspiring students can be transformed into skilled and well-rounded professionals with strong understanding of fundamentals, a flair for responsible innovation in engineering practical solutions applying the fundamentals, and confidence and poise to meet the challenges in their chosen professional spheres.

## Mission

The management believes imparting quality education in an atmosphere that motivates learning as a social obligation which we owe to the students, their parents/guardians and society at large and hence the effort is to leave no stone unturned in providing the same with all sincerity. Towards that end, the management believes special focus has to be on the following areas:

M1: Have on-board staff with high quality experience and continuously updating themselves with latest research developments and sharing that knowledge with students.

M2: Having a well stream-lined teaching learning process that is continuously assessed for effectiveness and fine-tuned for improvement.

M3: Having state-of-the-art lab and general infrastructure that gives students the necessary tools and means to enhance their knowledge and understanding.

M4: Having a centralized department focused on improving placement opportunities for our students directly on campus and coordinating the training programs for students to complement the curriculum and enhance their career opportunities.

M5: Having advanced research facilities and more importantly atmosphere to encourage students to pursue self-learning on advanced topics and conduct research.

**ABOUT THE INSTITUTION:**

Maharajah Alak Narayan Society of Arts and Science (MANSAS) is an Educational Trust founded by Dr. (late) P.V.G Raju, Raja Saheb of Vizianagaram in the hallowed memory of his father Maharajah Alak Narayan Gajapati with a view to confound socio-economic inequalities in the Vizianagaram principality executing a trust deed on 12-11-1958 duly established Maharajah's College and other educational institutions in and around Vizianagaram. The Trust is a charitable one published under Section 6 a (1) of A.P Charitable and Hindu Religious Institutions and Endowment Act 30 of 1987.

The object of the Trust is to manage the properties of educational institutions under it and to promote and advance the cause of education in general, besides awarding scholarships to deserving students enabling them to undergo special training in science and industries in and out of India. The Trust has made an uncompromising contribution to the nation by presenting the stalwarts.

Trust offers KG to PhD level education in Arts, Sciences, Law, Pharmacy, Humanities Education, Engineering and Management and presently houses 13 Educational Institutions. MVGR College of Engineering is one of the 13 Institutes.

## Other Institutions under MANSAS

1. M.R. HIGH SCHOOL 1857
2. M.R COLLEGE **(NAAC ACCREDITED)** 1879
3. M.R. COLLEGE OF EDUCATION 1950
4. M.R. WOMENS COLLEGE **(NAAC ACCREDITED)** 1962
5. M.R. GIRLS HIGH SCHOOL 1974
6. M.R. MODEL HIGH SCHOOL 1974
7. M.R. ENGLISH MEDIUM SCHOOL 1979
8. M.R.V.R.G.R LAW COLLEGE 1987
9. M.R. P.G. COLLEGE **(NAAC ACCREDITED)** 1987
10. M.R.SCHOOL OF MANAGEMENT STUDIES 1994
11. M.R.V.R.G.R – II MEMORIAL JR. COLLEGE 1994
12. M.R. COLLEGE OF PHARMACY 2004

Maharaj Vijayaram Gajapathi Raj (MVGR) College of Engineering was established in the year 1997 by Maharaj Alak Narayan Society for Arts and Sciences (MANSAS) to impart quality technical education. The Institution is located in lush green, serene and pollution free environment spread over 60 acres of land in Chintalavalasa village situated in the outskirts of Vizianagaram, a fort city in the north coastal region of Andhra Pradesh.

Institution at a glance:

- MVGR is a 23 years old institution, established in 1997
- All eligible UG Programs (CHEMICAL, CIV, CSE, ECE, EEE, IT & MECHANICAL) were reaccredited by NBA.
- MBA program was also re-accredited by NBA.
- Had been re-accredited with Grade 'A' by NAAC of UGC
- Has Permanent affiliation with JN Technological University-Kakinada
- Listed under sections 2(f) & 12(b) of UGC act 1956.
- Approved by AICTE-New Delhi
- EIGHT departments are recognized as RESEARCH CENTERS by JNTU-K
- Granted Autonomy by UGC in 2015
- Campus of 60 acre
- Offering 7 UG and 5 M.Tech., and 1 MBA program
- About 250 faculty of which 84 Ph.D. Degree holders
- 83 Laboratories with an investment of about 13 Crores
- Total built up area of about 7 Lakh Sft
- About 42,000 volumes and Access to 8 international online journal packages like IEEE, SPRINGER, etc.
- 1420 Systems & 395 Mbps band width internet facility
- About Rs. 4 Crore worth of on-going R&D projects
- Actively involved in civil engineering consultancy work as Third Party Quality Auditor for Vizianagaram Municipality
- WIPRO Recognized technology learning center and MISSION 10X partner institution
- Recognized National Instruments Academy for Training in LabView
- SIRO Recognition by DSIR
- Recognized PTC Centre of Excellence for Creo Training
- Identified by MSME as Business Incubation Centre
- APSSDC-Siemens Technical Skill Development Institute
- Recognized CMs SKILL EXCELLENCY CENTER (SEC)
- Microsoft Ed-vantage Platinum Partner
- Institutional member of IUCEE
- Institutional Member of CII
- Member, Chamber of Commerce, Vizianagaram
- Green Campus award by Govt. of AP

MVGR College of Engineering is rated as one among the best engineering colleges in the state of Andhra Pradesh as it set up highest standards in all areas of curricular, co-curricular and extra-curricular activities and in students' placements. Based on industry and expert's feedback, the college is updating the curriculum from time to time. The college offers many value added add-on courses students and conducts training programs to meet the industries' requirements.

# Academic Regulations for B.Tech., Program

Applicable to the students admitted from the Academic year 2019-2020 onwards.

## 1. PROGRAM STRUCTURE:

### B.Tech.:

| Sl. No | Category | Credits |
|---|---|---|
| 1 | Humanities and Social Sciences including Management courses | 12 |
| 2 | Basic Science courses | 25 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. | 26 |
| 4 | Professional core courses | 54 |
| 5 | Professional Elective courses relevant to chosen specialization/branch | 18 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects | 12 |
| 7 | Project work, seminar and internship in industry or elsewhere | 13 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge] | 0 |
| | **Total** | 160 |

- Open electives offered by the parent department are listed in the course structure and are offered to students of other programs. The students of parent departments may also opt the course, provided it shall not be listed in the curriculum.
- For audit course a student is deemed to satisfy the minimum contact hours, as prescribed by the department and shall also comply with the requirements for submission of assignments/projects. A student shall also opt for MOOCs and submit the certificate.

| 1. HSS Courses | | |
|---|---|---|
| Sl. No. | Subject | Credits |
| 1 | English -1 | 3 |
| 2 | English -2 (Technical English) | 3 |
| 3 | Elective-1 (Management Related course (MEFA or MS or Operations Research) | 3 |
| 4 | Elective-2 (Professional Ethics and Human Values) | 3 |
| | Total | **12** |

| 2. Basic Science Courses | | |
|---|---|---|
| Sl. No. | Subject | Credits |
| 1 | Mathematics-I | 3 |
| 2 | Mathematics-II | 3 |
| 3 | Mathematics-III | 3 |
| 4 | Mathematics-IV | 3 |
| 5 | Applied / Engineering Physics (Theory + Lab) | 5 |
| 6 | Engineering Chemistry (Theory + Lab) | 5 |
| 7 | Biology for Engineers | 3 |
| | Total | **25** |

| 3. Engineering Science Courses | | |
|---|---|---|
| Sl. No. | Subject | Credits |
| 1 | Programming for Problem Solving (Theory + Lab) | 5 |
| 2 | Internet of Things (IOT) | 3 |
| 3 | Computer aided Engineering Graphics | 3 |
| 4 | Basic Electrical Engineering (Theory + Lab) | 5 |
| 5 | Department wise Engineering Science Course-I (AI Tools , Techniques & Applications) | 5 |
| 6 | Department wise Engineering Science Course-II (Design thinking and Product Innovation) | 3 |
| 7 | Workshop (Department Specific) | **2** |
| | Total | **26** |

| | Subjects | Credits |
|---|---|---|
| 1 | Professional Core Courses | 54 |
| 2 | Professional Elective Courses Relevant to Chosen Specialization/Branch | 18 |
| 3 | Open Subjects – Electives from other Technical and / or Emerging Subjects | 12 |
| | | **84** |

| 7. Project | | |
|---|---|---|
| Sl. No. | Subject | Credits |
| 1 | Socially Relevant Project | 1 |
| 2 | Mini Project | 2 |
| 3 | Project Phase - I | 2 |
| 4 | Project Phase - II | 8 |
| | Total | **13** |

| 8. Audit Courses (Non Credit Course) | | |
|---|---|---|
| Sl. No. | Subject | |
| 1 | Induction Program | |
| 2 | Constitution of India | |
| 3 | Indian Traditional Knowledge | |
| 4 | Environmental Science | |

BOS Chairman shall notify the list of MOOCs offered (Open Elective & Professional Elective) in the beginning of the semester.

## 2. PROGRAM PATTERN:

**B.Tech.:** The program is for 4 academic years / 8 semesters.

**B.Tech. (Lateral Entry):** The program is for 3 academic years / 6 semesters.

## 3. AWARD OF DEGREE:

**B.TECH:**

A student will be declared eligible for the award of degree if he/she fulfills the following academic regulations.

a) A student shall be declared eligible for the award of degree, if he/she pursues a course of study for not less than four academic years and not more than eight academic years from the date of admission.

b) The student shall register for **160** credits and secure all **160** credits.

c) The medium of instruction for the entire under graduate program in Engineering & Technology will be in **English** only.

d) A student shall also register and successfully complete audit programs (Non-credit) as recommended by Academic Council.

e) A student on completing 1$^{st}$ year class work may opt for a break of 1 year which shall be deemed as GAP year, as recommended by APSCHE, for undertaking successful entrepreneurial ventures.

f) Students who fail to complete Four Years Course of study within 8 years shall forfeit their seat and their admission shall stand cancelled.

**B.TECH (Lateral Entry):**

A student will be declared eligible for the award of degree on fulfilling the following academic requirements.

a) A student shall be declared eligible for the award of the degree, if he/she pursues a course of study for not less than three academic years and not more than six academic years.

b) The student shall register for **126** credits and secure all **126** credits.

c) A student shall also register and successfully complete audit programs (Non-credit) as recommended by Academic Council.

d) Students who fail to complete their three Years Course of study within 6 years shall forfeit their seat and their admission shall stand cancelled.

e) Student shall register for bridge programs, if any, as administered by the respective departments at the beginning of 2nd year and successfully complete as per the guidelines of the Institution.

## 4. CERTIFICATION PROGRAMS:

| Sl. No. | Dept. | Name of the Program |
|---|---|---|
| 1 | MECH | Windchill 10.2 PDM by Adroitec Engineering Solutions Pvt. Ltd., Hyderabad |
| 2 | MECH | Creo 2.0 by PTC |
| 3 | MECH | Edgecam by Verosoft, UK |
| 4 | MECH | ANSYS Training and Certification by Mechanical Department |
| 5 | MECH | AUTOCAD Training and Certification by Mechanical Department |
| 6 | MECH | Catia by APSSDC-Dassault Systems, CM's Center of Excellence |
| 7 | MECH | Delmia by APSSDC-Dassault Systems, CM's Center of Excellence |
| 8 | MECH | Simulia by APSSDC-Dassault Systems, CM's Center of Excellence |
| 9 | MECH | 2-Wheeler Automobile Certification by APSSDC-SIEMENS |
| 10 | MECH | 4-Wheeler Automobile Certification by APSSDC-SIEMENS |
| 11 | MECH | Welding Certification by APSSDC-SIEMENS |
| 12 | MECH | CNC Certification by APSSDC-SIEMENS |
| 13 | MECH | Commercial Electrical Certification by APSSDC-SIEMENS |
| 14 | MECH | Solid Edge Certification by APSSDC-SIEMENS |
| 15 | CHEM | Chemical Process Design and Simulation by Simtech Simulations, Hyderabad |
| 16 | ECE | Embedded Systems by Think LABS, Mumbai |
| 17 | ECE | Labview by National Instruments Systems India Pvt. Ltd. |
| 18 | ECE | Unified Technology Learning Program (UTLP) by Wipro Mission 10X |
| 19 | CSE, IT | PEGA by Virtusa Corporation |
| 20 | CSE, IT | Microsoft technologies by Microsoft Corp. |
| 21 | CSE, IT | Ethical Hacking by EC-Council Academia |
| 22 | CSE, IT | Java and C by Talent Sprint |
| 23 | CSE, IT | Network Analyst (CCNA) by Cisco Systems Inc |
| 24 | CSE, IT | Java Programming (OCJP) and DBMS by Oracle |
| 25 | EEE | PLC, Drives and Automation by Siemens |
| 26 | EEE | PLC by New Dawn Automation |
| 27 | EEE | Home Electrical Certification by APSSDC-SIEMENS |
| 28 | Civil | Remote Sensing and GIS by Indian Institute of Remote Sensing |

a) The Institution shall offer the certification programs by itself or in collaboration with industry/such other Institutions deemed to have specialized expertise in the proposed area of training.
b) Only students of the Institution shall be eligible to register on payment of prescribed fee.
c) However, subject to availability of resources and the demand the Institution may offer the program to external candidates meeting the pre-qualification requirements and in the order of the merit.
d) The duration of the course and design of the content shall be done by the respective departments of the Institution by themselves or in collaboration with industry/such other institutions deemed to have specialized expertise in the proposed area of training.
e) If the duration of the course is less than or equal to 40 hours, it can be completed in one semester, otherwise, it can suitably distributed over a number of semesters.
f) Mere enrolment/registration for the program shall not entitle any claim for award of certificate.
g) A candidate shall be deemed eligible for the award of the certificate if he/she
   - Attends at least 75% of scheduled training sessions
   - Complies to all the requirements of submission of the assignments, presentations, seminars, projects, etc., and also appears for periodic tests.
   - Shall attain minimum levels of performance in tests as prescribed.
   - Shall remit such fee as deemed fit for the certification
   - A candidate registered and failed to meet the requirements shall be permitted to repeat the said training one another time after remitting 25% of the fee fixed for the program as re-registration fee.

If the student is absent for the periodic tests, the test shall be re-conducted on payment of 10% of fee.

## 5. COURSES OFFERED:

| Name of the Program | Degree |
|---|---|
| UG Programs (Engineering & Technology) | B.Tech. (Civil)<br>B.Tech. (EEE)<br>B.Tech. (Mech.)<br>B.Tech. (ECE)<br>B.Tech. (CSE)<br>B.Tech. (CHEM)<br>B.Tech. (IT) |
| PG Programs (Engineering & Technology) | M.Tech. (Structural Engineering)<br>M.Tech. (Power Systems)<br>M.Tech. (PDM)<br>M.Tech. (VLSI)<br>M.Tech. (CN&IS) |
| Other PG Programs | MBA |
| Research Programs | Ph.D. in Civil, EEE, MECH, ECE, CSE, CHEM, MBA and MATHS |

## 6. DISTRIBUTION AND WEIGHTAGE OF MARKS:

**B.Tech.:**

a). All Theory courses will have 5 units and assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end external examination.

**Internal Assessment:**

Subjective tests - 20 Marks
Objective tests - 10 Marks
Assignments - 10 Marks

- Two subjective tests shall be conducted.
- Each subjective test shall be conducted for 90 Minutes and have 3 questions each for 7 marks (No choice) and the same shall be scaled down to 20 Marks.
- Average of two subjective tests shall be considered.
- Two objective tests (online) shall be conducted each for 20 marks.
- Each objective test shall be conducted for 20 minutes and have 20 Multiple Choice Questions each for 1 mark and the same shall be scaled down to 10 Marks.
- Average of two objective tests shall be considered.
- Assignments shall be assessed for 10 marks.

**External Assessment:**

- External examination is for 60 marks (180 min). Question paper contains 10 questions (2 questions from each unit) and each question carries 12 marks. Student shall answer 5 questions (1 question from each unit).

**i) Design Thinking and Product Innovation - Evaluation pattern**

**Internal Assessment: 40 Marks**

Project based learning - 20 Marks
Assignments - 20 Marks

**Project based learning:** The student has to identify a problem and provide a solution by applying design thinking methodologies and submit a report, which is assessed for 20 Marks.

**Assignments:** The student has to submit 4 assignments (1 for each unit) and assessed for 20 marks. Each assignment shall consist of 4 questions (4X10 = 40 marks) and the same shall be scaled down to 20 marks. Average of 4 assignments shall be considered as final assignment marks.

**External Assessment: 60 Marks**

External examination is for 60 marks (180 min). Question paper contains 8 questions from first IV units (2 questions from each unit) and each question carries 10 marks. Student shall answer 4 questions from first IV units (1 question from each unit) and case study (20 Marks) from V unit.

**ii) Internet of Things (IoT) , Surveying and Geomatics, MAT Lab Programming, Programming with Lab View, Embedded Processor - Evaluation pattern**

**Internal Assessment: 40 Marks**

Subjective Test - 20 Marks

Project based learning - 20 Marks

- Two subjective tests shall be conducted.
- Each subjective test shall be conducted for 90 Minutes and have 3 questions each for 7 marks (No choice) and the same shall be scaled down to 20 Marks.
- Average of two subjective tests shall be considered.
- Project based learning shall be assessed for 20 Marks.
- In Project based learning, a student has to identify a problem such that at least 3 or 4 modular learning of experiments shall be integrated and submit comprehensive report with solution at the end of the semester.

**External Assessment: 60 Marks**

External examination is for 60 marks (180 min). Question paper contains 10 questions (2 questions from each unit) and each question carries 12 marks. Student shall answer 5 questions (1 question from each unit).

b). **Laboratory/Practice:**

All Laboratory/Practice courses are assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end external examination.

**Internal Assessment : (40 Marks)**

Continuous assessment : 15 Marks
Project based learning : 15 Marks
Internal test : 10 Marks

- Continuous assessment for 15 marks for each experimental session finally averaged to 15 marks.
- Project based learning shall be assessed for 15 Marks.
- In Project based learning, a student has to identify a problem such that at least 3 or 4 modular learning of experiments shall be integrated and submit comprehensive report with solution at the end of the semester.
- An internal assessment test conducted at the end of the semester shall be assessed for 10 marks.

**Semester End Assessment:**

- Semester end examination is for 60 marks (180 min) conducted and assessed by both external and internal examiners.

- Both internal and external examination shall include assessment of the student on
    a) Knowledge of principles/concepts involved
    b) Experimental design
    c) Result interpretation and analysis
    d) Experimental report

c). **Drawing/Design/Estimation:**

**i) Computer Aided Engineering Graphics:**

**Evaluation Procedure:**

The course will have 5 units and assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end external examination.

**Internal Assessment : (40 Marks)**

| | |
|---|---|
| Continuous assessment | : 15 Marks |
| Project based learning | : 15 Marks |
| Internal test | : 10 Marks |

**Semester End Assessment:**

- Semester end examination is for 60 marks (180 min) conducted and assessed by both external and internal examiners.
- Question paper contains 3 questions (with internal choice). **E**ach question carries 20 marks (5 marks for free hand drawing and list of commands & 15 marks for final drawing prepared in AUTOCAD). A Student shall answer all questions.

**ii) Computer Aided Geometric Design and Assembly:**

**Evaluation Procedure:**

The course will have 5 units and assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end external examination.

**Internal Assessment : (40 Marks)**

| | |
|---|---|
| Continuous assessment | : 15 Marks |
| Project based learning | : 15 Marks |
| Internal test | : 10 Marks |

**Semester End Assessment:**

- Semester end examination is for 60 marks (180 min) conducted and assessed by both external and internal examiners.
- Semester End Examination shall include assessment of the student on Final drawings like modeling, assembly and drafting.
- Student is expected to execute one exercise.

- Final drawings like modeling, assembly and drafting hard copies shall be evaluated by both internal and external examiners

### iii) Design and Drawing Courses

**Evaluation Procedure:**

The course will have 5 units and assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end external examination.

| **Internal Assessment:** | **40 Marks** |
|---|---|
| Subjective Test | - 20 Marks |
| Assignments | - 10 Marks |
| Design and Drawing reports | - 10 Marks |

- Two subjective tests shall be conducted.
- Each subjective test shall be conducted for 90 Minutes and have 3 questions each for 7 marks (No choice) and the same shall be scaled down to 20 Marks.
- Average of two subjective tests shall be considered.
- Assignments shall be assessed for 10 marks.
- Design and drawing reports shall be assessed for 10 marks.

**External Assessment:**

The end examination question paper consists of Part A and Part B.
Part A consists of two questions regarding Design and Drawing (from two clusters clearly mentioned in the syllabus). Each question carries 20 marks. The student shall answer any 1 question.
Part B consists of four questions (from the remaining four clusters) with internal choice and all four are to be answered. Each question carries 10 marks.

### iv) Estimation and Costing Courses

The course will have 5 units and assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end external examination.

| **Internal Assessment:** | **40 Marks** |
|---|---|
| Subjective Test | - 20 Marks |
| Assignments | - 10 Marks |
| Bar bending schedules, | - 10 Marks |
| Estimation and cost analysis reports | |

Two subjective tests shall be conducted.

- Each subjective test shall be conducted for 90 Minutes and have 3 questions each for 7 marks (No choice) and the same shall be scaled down to 20 Marks.
- Average of two subjective tests shall be considered.
- Assignments shall be assessed for 10 marks.
- Bar bending schedules, Estimation and cost analysis reports shall be assessed for 10 marks.

**External Assessment:**

External examination is for 60 Marks. The question paper consists of 2 questions. Each question carries 60 Marks. The student shall answer 1 question.
In each question, the section, plan and reinforcement drawings of various members of a building will be given and the following items are to be calculated.

- Quantities of all the items (20 Marks).
- Reinforcement tonnage and Bar bending schedule (10 Marks).
- Specifications (10 Marks).
- Rates of all the items as per Standard Schedule of Rates (20 Marks).

**Integrated Course (Theory + Lab):**

**Theory and Lab shall be assessed for 200 Marks (Each 100 marks)**

- For Integrated course, the theory shall be assessed for 100 marks, of which 40 marks for internal assessment and 60 marks for semester end external examination.
- The Lab shall be assessed for 100 marks , of which, 40 marks for internal assessment and 60 marks for semester end external examination

**Socially Relevant Project:**

- A student shall identify and provide a solution to the problem relevant to society/Profession/Industry.
- A student shall engage at least 15 hours on socially relevant project. Socially relevant project shall be evaluated internally for 50 marks by Project Review Committee (PRC). PRC comprising of HoD, department Academic Coordinator, R&D member of the department, one senior faculty and guide shall review the progress.

**Mini Project:**

- A student shall undergo internship for a period of 4 weeks/provide solution to the problem relevant to Industry/ Modern tool during the vacation after VI semester and submit comprehensive report.
  - Mini project shall be evaluated internally for 50 marks by Project Review Committee (PRC).
  - PRC shall prepare rubrics for assessment.

**Project Evaluation**:

Project is divided into 2 phases – Phase I & Phase II

- Evaluation shall comprise of internal and external assessment.

  Internal: 110 (Phase I 50 marks, Phase II 60 Marks)

  External: 90

- A project Review committee (PRC) comprising of HoD, department Academic Coordinator, R&D member of the department, one senior faculty and guide shall review the progress once in four weeks.

**Project Phase I:**

- Project Phase I shall be evaluated internally by PRC for 50 Marks.
- A student shall undertake project phase I during the VII semester.
- A student shall report to the guide/external supervisor and work under his supervision at least 2 hours per week.
- Assessment shall be on
  - Literature review
  - Identification and statement of the Problem

**Project Phase II:**

- A student shall undertake project phase II during the VIII semester.
- A student shall report to the guide/external supervisor and work under his supervision at least 8 hours per week.
- Internal evaluation shall be done by HoD, department Academic Coordinator, R&D member of the department, one senior faculty and guide for 60 marks.
- External evaluation shall be done by HoD, Guide/Internal Examiner and External Examiner for 90 marks.
- Assessment shall be on
  a) Review on fundamental knowledge involved
  b) Inter disciplinary aspect
  c) Experimental/methodology design
  d) Result analysis and interpretations
  e) Report writing
  f) Team work
  g) Presentation
  h) Viva-voce

**B.Tech. (Lateral Entry):**

The rules and regulations for candidates admitted under lateral entry category for $2^{nd}$, $3^{rd}$ and $4^{th}$ years of study shall be same as applicable to regular B.Tech students.

## 7. ATTENDANCE REGULATIONS:

**B.Tech.:**

I. A student shall be eligible to appear for end semester examinations, if he or she acquires a minimum of 75% of attendance in aggregate of all the subjects (Theory & Lab.) for the semester.

II. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the college academic committee.

III. Shortage of attendance below 65% in aggregate of all the subjects (Theory & Lab) for the semester shall not be Condoned.

IV. Detained student shall seek re- admission for that semester when offered within 4 weeks from the date of commencement of class work.

**PROMOTION RULE (Based on attendance):**

- A Student shall be promoted to the next semester on fulfillment of minimum attendance requirement (75%) of current semester.

**PROMOTION RULE (Based on credits):**

- A student shall be promoted from IV semester to V semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits up to IV semester from the following examinations irrespective of whether the candidate takes the examination or not.
    - Two regular and Two supplementary examinations of I semester
    - Two regular and One supplementary examinations of II semester
    - One regular examination and One supplementary examination of III semester
    - One regular examination of IV semester.
- A student shall be promoted from VI semester to VII semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits up to VI semester from the following examinations irrespective of whether the candidate takes the examination or not.
    - Three regular and Three supplementary examinations of I semester
    - Three regular and Two supplementary examinations of II semester
    - Two regular and Two supplementary examinations of III semester
    - Two regular and One supplementary examinations of IV semester
    - One regular and One supplementary examination of V semester
    - One regular examination of VI semester.

**B.TECH (Lateral Entry):**

**PROMOTION RULE (Based on attendance):**

A Student shall be promoted to the next semester on fulfillment of minimum attendance requirement of current semester.

**PROMOTION RULE (Based on credits):**

A student shall be promoted from VI semester to VII semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits up to VI semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Two regular and Two supplementary examinations of III semester
- Two regular and one supplementary examinations of IV semester
- One regular and One supplementary examinations of V semester
- One regular examination of VI semester.

**B.Tech. (Lateral Entry):**

The rules and regulations for candidates admitted under lateral entry category for 2nd, 3rd and 4th years of study shall be same as applicable to regular B.Tech students.

## 8. MINIMUM ACADEMIC REQUIREMENTS:

**B.Tech.: (Theory/Lab)**

i. A student is deemed to have satisfied the minimum academic requirements for a course on securing at least 24 marks out of 60 marks at semester end examination and overall minimum of 40 marks out of 100 marks including internal assessment.

ii. **Integrated Course (Theory + Lab):**

- The student shall secure minimum 24 marks out of 60 marks at semester end examination and overall 40 marks out of 100 marks for Theory and Laboratory courses independently. In case of failure in either theory or Laboratory course, the student should re-appear for both theory and laboratory.
- The assessment shall be done independently for both theory and laboratory courses and final marks shall be calculated on weighted average method for converting marks into grade points.

**Sample calculation:**

Integrated course-5 credits. Theory is for 3 credits and laboratory is for 2 credits.

Total Marks obtained in theory: 70 out of 100 (3 Credits)

Total Marks obtained in Lab : 90 out of 100 (2 Credits)

Final marks of the integrated course is

(70X3 + 90X2) / 5 = 78 Marks

**B.Tech. (Lateral Entry):**

The rules and regulations for candidates admitted under lateral entry category for 2nd, 3rd and 4th years of study shall be same as applicable to regular B.Tech students.

## 9. GRADING SYSTEM:

**B.Tech. / B.Tech. (Lateral Entry)**

Semester Grade Point Average (SGPA) for the current semester which is calculated on the basis of grade points obtained in all courses, except audit courses and courses in which satisfactory or course continuation has been awarded,

SGPA= Σ (course credits earned x Grade points) /
Σ (Total course credits in the semester.

**CGPA= Σ (course credits earned x Grade points) up to successfully completed semesters ) / Σ (Total course credits up to successfully completed)**

The UGC recommends a 10-point grading system with the following letter grades as given below:

| | | |
|---|---|---|
| O | (Outstanding) | 10 |
| A+ | (Excellent) | 9 |
| A | (Very Good) | 8 |
| B+ | (Good) | 7 |
| B | (Above Average) | 6 |
| C | (Average) | 5 |
| P | (Pass) | 4 |
| F | (Fail) | 0 |
| Ab | (Absent) | 0 |

- iii. A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

**Illustration of Computation of SGPA and CGPA and Format for Transcripts**

Computation of SGPA and CGPA

**Illustration for SGPA**

| Course | Credit | Grade Letter | Grade point | Credit Point (Credit x Grade) |
|---|---|---|---|---|
| Course 1 | 3 | A | 8 | 3 X 8 = 24 |
| Course 2 | 4 | B+ | 7 | 4 X 7 = 28 |
| Course 3 | 3 | B | 6 | 3 X 6 = 18 |
| Course 4 | 3 | O | 10 | 3 X10 = 30 |
| Course 5 | 3 | C | 5 | 3 X 5 = 15 |
| Course 6 | 4 | B | 6 | 4 X 6 = 24 |
| | **20** | | | **139** |

Thus, **SGPA** =139/20 = 6.95

**Illustration for CGPA**

| **Semester 1** | **Semester 2** | **Semester 3** | **Semester 4** | **Semester 5** | **Semester 6** |
|---|---|---|---|---|---|
| Credits: 16 | Credits: 18 | Credits: 25 | Credits: 21 | Credits: 23 | Credits: 22 |
| SGPA: 7.9 | SGPA: 7.8 | SGPA: 7.6 | SGPA: 8.0 | SGPA: 8.3 | SGPA: 8.6 |

| **Semester 7** | **Semester 8** |
|---|---|
| Credits: 21 | Credits:14 |
| SGPA: 8.2 | SGPA: 8.5 |

Thus,

**CGPA**= $\frac{16x7.9 + 18x7.8 + 25x7.6 + 21x8.0 + 23x8.3 + 22x8.6 + 21x8.2 + 14x8.5}{160}$ = **8.1**

## 10. ELIGIBILITY FOR AWARD OF DEGREE:

**B.Tech:**

A student shall be eligible for award of the degree if he/she fulfills the following conditions:

1) Successfully completes all the courses prescribed for the Program.
2) CGPA greater than or equal to 4.5(Minimum requirement for Pass),

## 11. AWARD OF CLASS:

**B.Tech:**

Eligible Candidates for the award of B.Tech., Degree shall be placed in one of the following Classes based on CGPA.

| Class | CGPA |
|---|---|
| Distinction | $\geq 7.5$ |
| First Class | $\geq 6.5$ |
| Second Class | $\geq 5.5$ |
| Pass class | $\geq 4.5$ |

## 12. INSTRUCTION DAYS:

A semester shall have a minimum of 90 clear instruction days (including internal examinations).

**13. Transfers from other Institutions shall not be permitted**.

## 14. SUPPLEMENTARY EXAMINATIONS:

Supplementary examinations shall be conducted within 4 weeks from the date of announcement of results of regular examinations.

**15. WITHHOLDING OF RESULTS:** The result of a student shall be withheld

- If the student has not paid the dues, if any, to the institution
- If any case of pending disciplinary action ,
- Involvement in any sort of malpractices etc.
- Involvement in ragging.

## 16. TRANSITORY REGULATIONS:

a) Detained candidates are eligible for re-admission as and when next offered.

b) The re-admitted candidate will be governed by the rules and regulations under which the candidate has been admitted.

c) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.

d) The students seeking transfer to colleges affiliated to JNTUK from various other Universities/ Institutions have to obtain the credits of any equivalent subjects as prescribed by JNTUK. The transferred candidates have to write the backlogs/failed subjects, if any, in the same Institution where he/she was admitted.

## 17. AMENDMENTS TO REGULATIONS:

The Academic Council of MVGR College of Engineering (Autonomous) reserves the right to revise, amend, change or nullify the Regulations, Schemes of Examinations, and/ or Syllabi or any other such matter relating to the requirements of the program which are compatible to the contemporary/emerging trends effectively meeting the needs of society/industry/stake holding groups.

## 18. Regulations for MALPRACTICES during the conduct of examinations

| | Nature of Malpractices/Improper conduct | Punishment |
|---|---|---|
| 1 (a) | If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) | Expulsion from the examination hall and cancellation of the performance in that subject only. * |
| (b) | If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him. * |

| | | |
|---|---|---|
| 2 | If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.<br>The Hall Ticket of the candidate is to be cancelled.<br>* |
| 3 | If the candidate impersonates any other candidate in connection with the examination. | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider/candidate not on rolls, he will be handed over to the police and a case is registered against him.<br>* |
| 4 | If the candidate mishandles the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.<br>Also if the answer script is mutilated / damaged disturbing the shape, of the script, answers, the bar code intentionally. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. He shall be debarred from class work and all examinations and be allowed to reregistered for the next subsequent odd or even semester only. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.* |

| | | |
|---|---|---|
| 5. | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | The same should be brought to the notice of CE who in turn in consultation with malpractice committee makes decision for cancellation of the performance in that subject.<br>* |
| 6. | Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination. | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.<br>* |
| 7. | Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. * |
| 8. | Possess any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. * |

| | | |
|---|---|---|
| 9. | If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8. | Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat.<br>Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them. * |
| 10 | Comes in a drunken condition to the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. * |
| 11 | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny. | Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.* |

*

**19. General :**

- Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
- The academic regulation should be read as a whole for the purpose of any interpretation.
- In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

* * *

# Ragging

## Prohibition of ragging in educational institutions Act 26 of 1997

### Salient Features

- **Ragging within or outside any educational institution is prohibited.**
- **Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student**

| | Imprisonment upto | | Fine Upto |
|---|---|---|---|
| Teasing, Embarrassing and Humiliation | 6 Months | + | Rs. 1,000/- |
| Assaulting or Using Criminal force or Criminal intimidation |  1 Year | + | Rs. 2,000/- |
| Wrongfully restraining or confining or causing hurt |  2 Years | + | Rs. 5,000/- |
| Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence |  5 Years | + | Rs. 10,000/- |
| Causing death or abetting suicide |  10 Months | + | Rs. 50,000/- |

**In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288**

**LET US MAKE MVGR A RAGGING FREE CAMPUS**

# Ragging

ABSOLUTELY NO TO RAGGING

**1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**

**2. Ragging entails heavy fines and/or imprisonment.**

**3. Ragging invokes suspension and dismissal from the College.**

**4. Outsiders are prohibited from entering the College and Hostel without permission.**

**5. Girl students must be in their hostel rooms by 7.00 p.m.**

**6. All the students must carry their Identity Cards and show them when demanded**

**7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

**PROGRAM STRUCTURE**

**B. TECH – MECHANICAL ENGINEERING**

**(A2 Regulation)**

| **SEMESTER-I** | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2MAT101 | Mathematics-I | 3 | - | - | 3 |
| 2 | A2CYI101 | Engineering Chemistry (Integrated Course) | 3 | - | 3 | 5 |
| 3 | A2EEI201 | Basic Electrical Engineering (Integrated Course) | 3 | - | 3 | 5 |
| 4 | A2MEW201 | Workshop | - | - | 3 | 2 |
| 5 | A2EHA701 | Constitution of India | 2 | - | - | 0 |
| **Total number of Credits:** | | | | | | **15** |

| **SEMESTER-II** | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2MAT102 | Mathematics-II | 3 | - | - | 3 |
| 2 | A2PYI101 | Engineering Physics (Integrated Course) | 3 | - | 3 | 5 |
| 3 | A2CII201 | Programming for Problem Solving (Integrated Course) | 3 | - | 3 | 5 |
| 4 | A2MED201 | Computer Aided Engineering Graphics | 1 | - | 3 | 3 |
| 5 | A2EHL001 | Essential Communication in English | 1 | - | 3 | 3 |
| **Total number of Credits:** | | | | | | **19** |

| **SEMESTER-III** | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2EHT001 | Effective Technical Communication | 2 | - | 2 | 3 |
| 2 | A2EHT002 | Professional Ethics and Human Values | 3 | - | - | 3 |
| 3 | A2CHT101 | Biology for Engineers | 3 | - | - | 3 |
| 4 | A2MAT106 | Mathematics-III | 3 | - | - | 3 |
| 5 | A2MET301 | Engineering Mechanics | 3 | - | - | 3 |
| 6 | A2MET302 | Engineering Thermodynamics | 3 | - | - | 3 |
| 7 | A2MET303 | Materials Engineering | 3 | - | - | 3 |
| 8 | A2MEL301 | Computer Aided Geometric Design and Assembly | - | - | 4 | 2 |
| 9 | A2CHA701 | Environmental Science | 2 | - | - | 0 |
| **Total number of Credits:** | | | | | | **23** |

| SEMESTER-IV | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2MAT110 | Mathematics-IV | 3 | - | - | 3 |
| 2 | A2MET202 | Design Thinking and Product Innovation | 3 | - | - | 3 |
| 3 | A2MET304 | Strength of Materials | 3 | - | - | 3 |
| 4 | A2MET305 | Fluid Mechanics and Fluid Machines | 3 | - | - | 3 |
| 5 | A2MET306 | Manufacturing Processes | 3 | - | - | 3 |
| 6 | A2MEI201 | AI Tools, Techniques and Applications (Integrated Course) | 3 | - | 3 | 5 |
| 7 | A2MEL302 | Materials Lab | - | - | 3 | 2 |
| 8 | A2MEP601 | Socially Relevant Project | - | - | 2 | 1 |
| 9 | A2EHA702 | Essence of Indian Traditional Knowledge | 2 | - | - | 0 |
| **Total number of Credits:** | | | | | | **23** |

| SEMESTER-V | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2MET201 | Industry Internet of Things (IIOT) | 2 | - | 2 | 3 |
| 2 | A2MET307 | Theory of Machines | 3 | - | - | 3 |
| 3 | A2MET308 | Design of Machine Elements | 3 | - | - | 3 |
| 4 | A2MET309 | Internal Combustion Engines | 3 | - | - | 3 |
| 5 | A2MET310 | Manufacturing Technology | 3 | - | - | 3 |
| 6 (PE-1) | A2MET401 | Advanced Strength of Materials | 3 | - | - | 3 |
| | A2MET402 | Surface Engineering | | | | |
| | A2MET403 | Automobile Engineering | | | | |
| | A2MET404 | Design and Analysis of Experiments | | | | |
| 7 (OE-1) | A2MST002 | OE-I: Human Resources Development and Organizational Behavior | 3 | - | - | 3 |
| 8 | A2MEL303 | Thermal Engineering Lab | - | - | 3 | 2 |
| **Total number of Credits:** | | | | | | **23** |

| SEMESTER-VI | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2MET001 | Operations Research | 3 | - | - | 3 |
| 2 | A2MET311 | Computer Aided Design and Analysis | 3 | - | - | 3 |
| 3 | A2MET312 | Applied Thermodynamics | 3 | - | - | 3 |
| 4 | A2MET313 | Heat Transfer | 3 | - | - | 3 |
| 5 (PE-2) | A2MET405 | Design of Transmission Systems | 3 | - | - | 3 |
| | A2MET406 | Leadership and Team Management | | | | |
| | A2MET407 | Aircraft and Jet Propulsion | | | | |
| | A2MET408 | Entrepreneurship | | | | |
| 6 (OE-2) | A2XXT5XX | | 3 | - | - | 3 |
| 7 | A2MEL304 | Simulation Laboratory | - | - | 3 | 2 |
| 8 | A2MEP602 | Mini Project | - | - | 4 | 2 |
| **Total number of Credits:** | | | | | | **22** |

| SEMESTER-VII | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2MET314 | Metrology, Instrumentation and Control Systems | 3 | - | - | 3 |
| 2 | A2MEI301 | Manufacturing Systems (Integrated Course) | 3 | - | 2 | 4 |
| 3 (PE-3) | A2MET409 | Finite Element Analysis | 3 | - | - | 3 |
| | A2MET410 | Composite Materials | | | | |
| | A2MET411 | Refrigeration and Air Conditioning | | | | |
| | A2MET412 | Industrial Engineering and Management | | | | |
| 4 (PE-4) | A2MET413 | Mechanical Vibrations and Condition Monitoring | 3 | - | - | 3 |
| | A2MET414 | Creep, Fatigue and Fracture Mechanics | | | | |
| | A2MET415 | Computational Fluid Dynamics | | | | |
| | A2MET416 | Automation in manufacturing | | | | |
| 5 (PE-5) | A2MET417 | Mechatronic Systems | 3 | - | - | 3 |
| | A2MET418 | Non Destructive Testing | | | | |
| | A2MET419 | Power Plant Engineering | | | | |
| | A2MET420 | Six Sigma | | | | |
| 6 (PE-6) | A2MET421 | Product Lifecycle Management Initiative | 3 | - | - | 3 |
| | A2MET422 | Process Planning and Cost Estimation | | | | |
| | A2MET423 | Renewable energy resources | | | | |
| | A2MET424 | Total Quality Management | | | | |
| 7 | A2MEP603 | Project (Phase-I) | - | - | 4 | 2 |
| **Total number of Credits:** | | | | | | **21** |

| Semester - VIII | | | | | | |
|---|---|---|---|---|---|---|
| S.No | Course Code | Course Title | L | T | P | Credits |
| 1 | A2XXT5XX | Open Elective-III (MOOCS) | - | - | - | 3 |
| | A2MET507 | Waste Heat Recovery and Co-generation | | | | |
| | A2MET508 | Introduction to Nanotechnology | | | | |
| | A2MET509 | Material Characterization Techniques | | | | |
| 2 | A2XXT5XX | Open Elective-IV (MOOCS) | - | - | - | 3 |
| | A2MET510 | Project Management | | | | |
| | A2MET511 | Industrial Safety | | | | |
| | A2MET512 | Advanced Materials | | | | |
| 3 | A2MEP604 | Project (Phase-II) | - | - | 16 | 8 |
| Total Number of Credits | | | | | | **14** |

**Note:** Each department is offering 4 open elective courses. One elective course is from Humanities (Human Resources Development and Organizational Behavior) which is common to all Engineering departments. 2nd Open elective course should be opted from the other departments (List of Open elective courses offered by various departments are given below). 3rd and 4th Open elective courses (Emerging subjects) should be discipline centric.

## OPEN ELECTIVES

| OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF CIVIL ENGINEERING | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2CET501 | Remote Sensing and GIS | 3 | - | - | 3 |
| 2 | A2CET502 | Project Planning and Management | 3 | - | - | 3 |
| 3 | A2CET503 | Road Safety Engineering | 3 | - | - | 3 |
| 4 | A2CET504 | Geomatics | 3 | - | - | 3 |
| 5 | A2CET505 | Building Services | 3 | - | - | 3 |
| 6 | A2CET506 | Water Power Engineering | 3 | - | - | 3 |
| **OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF EEE** | | | | | | |
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2EET501 | Basic Control Systems | | | | |
| 2 | A2EET502 | Applied Electrical Engineering | | | | |
| 3 | A2EET503 | Electrical Safety | | | | |
| 4 | A2EET504 | Concepts of Electrical Wiring | | | | |
| 5 | A2EET505 | Basic Automation Course | | | | |
| 6 | A2EET506 | Illumination Engineering | | | | |
| **OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF MECHANICAL ENGINEERING** | | | | | | |
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2MET501 | Introduction to Robotics | 3 | - | - | 3 |
| 2 | A2MET502 | Solar and Wind Energy | 3 | - | - | 3 |
| 3 | A2MET503 | Production and Operations Management | 3 | - | - | 3 |
| 4 | A2MET504 | Micro Electromechanical Systems | 3 | - | - | 3 |
| 5 | A2MET505 | Product Lifecycle Management | 3 | - | - | 3 |
| 6 | A2MET506 | Foundation of Computational Fluid Dynamics | 3 | - | - | 3 |
| | | | | | | |
| **OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF ECE** | | | | | | |
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2ECT501 | Principles of Communication Engineering | 3 | - | - | 3 |
| 2 | A2ECT502 | Electronic Instrumentation | 3 | - | - | 3 |
| 3 | A2ECT503 | Biomedical Engineering | 3 | - | - | 3 |
| 4 | A2ECT504 | Modern Communication Systems | 3 | - | - | 3 |
| 5 | A2ECT505 | Transducers and Sensors | 3 | - | - | 3 |
| 6 | A2ECT506 | Principles of Mobile Communications | 3 | - | - | 3 |
| **OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF CSE & IT** | | | | | | |
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2CIT501 | Fundamentals of Data Structures | 3 | - | - | 3 |
| 2 | A2CIT502 | Object Oriented Programming with JAVA | 3 | - | - | 3 |
| 3 | A2CIT503 | Web Design and Development | 3 | - | - | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | A2CIT504 | Python Programming | 3 | - | - | 3 |
| 5 | A2CIT505 | NoSQL Databases | 3 | - | - | 3 |
| 6 | A2CIT506 | Data Analytics | 3 | - | - | 3 |
| **OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF CHEMICAL ENGINEERING** | | | | | | |
| **Sl. No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| 1 | A2CHT501 | Computational Fluid Dynamics | 3 | - | - | 3 |
| 2 | A2CHT502 | Non-Conventional Sources of Energy | 3 | - | - | 3 |
| 3 | A2CHT503 | Design & Analysis of Experiments | 3 | - | - | 3 |
| 4 | A2CHT504 | Industrial Waste Water Engineering | 3 | - | - | 3 |
| 5 | A2CHT505 | Green Chemistry & Technology | 3 | - | - | 3 |
| 6 | A2CHT506 | Air Pollution Control and Design of Equipment | 3 | - | - | 3 |

| A2MAT101 | SEMESTER - I | L | T | P | C |
|---|---|---|---|---|---|
| | MATHEMATICS-I (common to ALL branches) | 3 | 0 | - | 3 |
| | Total Contact Hours – 48 | | | | |

## SYLLABUS

### UNIT-I: LINEAR ALGEBRA-1

Rank of a matrix: Elementary row and column transformations, equivalent matrices, Echelon form of a matrix, calculation of rank by reducing the matrix to Echelon form. System of equations: Linear system of equations, homogeneous and non-homogeneous system of equations, consistency criteria, trivial and non-trivial solutions, solving system of equations by Rank method; Eigenvalues and Eigenvectors: Finding Eigenvalues and Eigenvectors, properties of Eigenvalues and Eigenvectors (statements) including spectral mapping theorem.

### UNIT- II: LINEAR ALGEBRA-2

Cayley-Hamilton Theorem: Statement of the theorem and its verification. Applications: Finding higher powers of a matrix, finding matrix polynomials, finding inverse of matrix. Diagonal form of a matrix: Reduction to diagonal form, spectral and modal matrices, finding higher powers of a matrix using diagonalisation, Quadratic forms: Matrix form of quadratic forms, orthogonal transformation, canonical form, reduction of quadratic form to canonical form by orthogonal transformation method, rank, index, signature and nature (definiteness) of a quadratic form.

### UNIT-III: FIRST ORDER DIFFERENTIAL EQUATIONS & APPLICATIONS

Outlines: Differential Equations(DEs), Order and degree of a DE, Formation of DEs, general solutions of a DE; Solving first order and first degree DEs: linear DEs, Bernoulli's DEs (reducible to linear), exact DEs, integrating factors, non-exact DEs (reducible to exact).

Applications to real world problems: Newton's law of cooling, laws of growth and decay, family of curves, orthogonality of families curves, orthogonal trajectories (Cartesian and polar curves).

### UNIT-IV: HIGHER ORDER DIFFERENTIAL EQUATIONS

Differential equations of higher order: Linear differential equations of higher order, its operator form. Solution concepts: General (complete) solution, particular solution. Solution of linear differential equations of higher order: Auxiliary equations, rules for finding complementary functions, rules for finding particular integrals (general and special methods).

### UNIT-V: LAPLACE TRANSFORMS

Laplace transformation: Laplace transformation of elementary functions, Properties: Linearity, change of scale, first shifting properties, finding Laplace transformations using properties, Advanced properties: Laplace transformations of derivatives and integrals, multiplication by $t^n$, division by t (statements), finding Laplace transformations

using advanced properties; Inverse Laplace transformations: Finding inverse Laplace transformations using partial fractions, statement of Convolution theorem, finding inverse Laplace transformations by Convolution theorem; Applications: Solving Initial Value Problems by using Laplace transformations.

//Topics prefixed with 'outlines / overview' are not for assessment//

**TEXT BOOKS:**

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
2. T.K.V. Iyengar et al, Engineering Mathematics, S. Chand Publishers, Revised edition

**REFERENCE BOOKS:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
3. T. Veerarajan, Higher Engineering Mathematics, Tata McGraw-Hill, 2008

**COURSE OUTCOMES:** Learners at the end of this course will be able to

| | | |
|---|---|---|
| CO 1 | KO#1 | Recall the concepts of Linear algebra |
| CO 2 | KO#2 | Recall the solution methods and applicability of first order differential equations |
| CO 3 | KO#3 | Recall the solution methods of higher order differential equations and the concepts of Laplace transforms |
| CO 4 | UO#1 | Use and interpret the concepts of linear algebra |
| CO 5 | UO#2 | Use and interpret solution methods and applicability of first order differential equations |
| CO 6 | UO#3 | Use and interpret solution methods of higher order differential equations and the concepts of Laplace transforms |
| CO 7 | AO#1 | Apply the concepts of linear algebra, differential equations and Laplace transformation to model and solve real world problems |

CO/PO Mapping

| Course Title: | Mathematics-I (Common to ALL Branches) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2MAT101 | | | | | | | | | | | | | |
| Course Designed by | Dept. of Mathematics | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO2 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO3 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO4 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO5 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO6 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO7 | 3 | 3 | | 2 | | | | | | | 2 | | | |

| | |
|---|---|
| Course designed by | DEPARTMENT OF MATHEMATICS |
| Approval | Approved by: Meeting of Board of Studies held on 06.07.2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2CYI101 | SEMESTER - I | L | T | P | C |
|---|---|---|---|---|---|
| | ENGINEERING CHEMISTRY (Common to all branches) | 3 | -- | 3 | 5 |
| | Total Contact Hours – 48 | | | | |

## SYLLABUS

### UNIT 1: WATER TECHNOLOGY

Introduction –Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles - Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

### UNIT 2: POLYMERS

Introduction to polymers, functionality of monomers, addition and condensation polymerization, copolymerization, stereospecific polymerization with specific examples. Thermoplastics and Thermo-sets – their differences.

Elastomers – applications with specific examples- Preparation, properties and uses of PVC, Bakelite, Teflon and Nylon-6, 6, Buna-S and Thiokol rubber- Fibre reinforced plastics – carbon fibre, glass fibre and aramids.

### UNIT 3: ELECTROCHEMISTRY AND APPLICATIONS

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells –dry cell- Secondary cells – lead acid, nickel-cadmium and lithium ion batteries- working of the batteries including cell reactions- Fuel cells, hydrogen-oxygen, and methanol fuel cells – working of the cells.

Corrosion: Introduction to corrosion, mechanism of dry and wet corrosion, Pilling Bedworth ratios and uses, Types of corrosion – Differential aeration corrosion, galvanic corrosion, pitting corrosion, waterline corrosion and stress corrosion, Factors affecting the rate of corrosion – metal based factors and environmental based factors, protection techniques – metal coatings – galvanization and tinning, cathodic protection, inhibitors – cathodic and anodic, organic coatings – paints – constituents and their functions.

### UNIT-4: CHEMISTRY OF ADVANCED MATERIALS

**NANOMATERIALS:** introduction- synthesis of Nano material by sol gel method- CVD- engineering applications of Nano materials

**CEMENT**: Introduction to ordinary Portland cement- manufacturing of OPC- setting and hardening of cement- decay of cement.

**FUELS**: Introduction- classification- liquid fuels- cracking- knocking- octane number and cetane number; Lubricants- definition- mechanism and properties of lubricants

### UNIT 5: INSTRUMENTAL METHODS AND APPLICATIONS

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Principle, instrumentation (Block diagram and working), applications of UV, IR and NMR spectroscopic methods. Chromatography- introduction- Ion exchange chromatography- applications

## COURSE OUTCOMES:

**CO1:** The student will have the ability to describe softening methods and desalination processes. He/ She will be able to explain various types of polymers; preparation, properties and engineering applications of thermoplastic, thermosetting plastics, rubbers and FRP's.

**CO2:** The student will have the ability to describe electrochemical reactions, principles of batteries, fuel cell and corrosion.

**CO3:** The student will have the ability to outline electromagnetic spectrum and explain the working principles of IR, UV, NMR and chromatographic techniques. The student describes the synthesis, properties and applications of nanomaterials, cement. HE/ She Outlines the cracking methods, knocking of fuels.

**CO4:** The student will have the ability to differentiate between hard and soft water, demineralization and deionization processes and thermosetting – thermoplastic materials.

**CO5:** The students will have the ability to give examples on primary and secondary batteries, various types of corrosion, methods of corrosion prevention.

**CO6:** The student will have the ability to draw inferences on the principles and applications of various instrumental methods and also can compare and contrast between cracking methods.

**CO7:** The student will have the ability to analyze water samples and validate the results obtained and apply their knowledge on polymers, batteries, materials and instrumentation.

*Text books:*


1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.


*Reference books:*


1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. H.Kaur, Instrumental Methods of chemical analysis, Pragathi Prakashan, 2012.
3. Chemistry for Engineers, Teh Fu Yen, Imperial college press, London


CO/PO Mapping

| Course Title: | Engineering Chemistry | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2CYI101 | | | | | | | | | | | | | |
| Course Designed by | Dept. of Chemistry | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | | | | | | | | 2 | | | 1 | | |
| CO2 | 3 | | | | | | | | 2 | | | 1 | | |
| CO3 | 3 | | | | | | | | 2 | | | 1 | | |
| CO4 | 3 | | | | | | | | 2 | | | 1 | | |
| CO5 | 3 | | | | | | | | 2 | | | 1 | | |
| CO6 | 3 | | | | | | | | 2 | | | 1 | | |
| CO7 | 3 | | | | | | | | 2 | | | 1 | | |

| Course designed by | DEPARTMENT OF CHEMISTRY |
|---|---|
| Approval | Approved by: Meeting of Board of Studies held on 29.06.2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

# Engineering Chemistry - Laboratory

**List of Experiments:**

1. Determination of HCl using sodium carbonate
2. Determination of Hardness of a groundwater sample.
3. pH metric titration of strong acid vs. strong base
4. Condcutometric titration of Strong acid VS Strong base
5. Condcutometric titration of Weak acid VS strong base
6. Potentiometric titration of Fe(II) with potassium dichromate
7. Determination of Strength of an acid in Pb-Acid battery
8. Preparation of a polymer
9. Determination of viscosity of polymer solution using survismeter
10. Determination of percentage of Iron in Cement sample by colorimetry
11. Estimation of Calcium oxide in port land Cement
12. Preparation of Nanomaterials (ex: Fe/ Zn/ Ferrite)
13. Adsorption of acetic acid by charcoal
14. Determination of acid value and saponification value of a given lubricant
15. Project based learning (Mandatory for all students)

## Course Outcomes:

**CO1:** The student will be able to determine total hardness, strength of acid in a lead acid battery, calcium in Portland cement using volumetric analysis

**CO2:** The student will be able to explain condcutometric, potentiometric, pH metric titrations and colorimetric determination.

**CO3:** The student will be able to explain the synthesis of a polymer, nanomaterials

CO/PO Mapping

| Course Title: | Engineering Chemistry | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2CYI101 | | | | | | | | | | | | | |
| Course Designed by | Dept. of Chemistry | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | | 1 | | | 1 | | | | 1 | 1 | 2 | | |
| CO2 | 3 | | 1 | | | 1 | | | | 1 | 1 | 1 | | |
| CO3 | 3 | | 1 | | | | | | | 1 | 1 | 1 | | |

| | |
|---|---|
| Course designed by | DEPARTMENT OF CHEMISTRY |
| Approval | Approved by: Meeting of Board of Studies held on 29.06.2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2EEI201 | SEMESTER – I | L | T | P | C |
|---|---|---|---|---|---|
| | **Basic Electrical Engineering** (Common to all branches) | 3 | - | 3 | 5 |
| | **Total Contact Hours – 50** | | | | |

## SYLLABUS

**UNIT 1: D.C. CIRCUITS**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, Analysis of simple circuits with DC excitation, Superposition, Thevenin's and Norton's Theorems, Time-domain analysis of first-order RL and RC circuits.

**UNIT 2: A.C. CIRCUITS**

Representation of sinusoidal waveforms, Average and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase AC circuits (Series & Parallel), Resonance, Three-phase balanced circuits, voltage and current relations in star and delta configurations.

**UNIT 3: DC & AC MACHINES [ELEMENTARY TREATMENT ONLY]**

Principle and operation of DC Generator - EMF equation – open circuit characteristic of DC shunt generator – principle and operation of DC Motor – Types of DC Motors – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of single-phase Transformer - OC and SC tests on transformer - principle and operation of single phase & Three phase Induction Motors, construction and working of synchronous motors

**UNIT 4: BASICS OF POWER SYSTEMS:**

Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary & Secondary distribution systems.

**UNIT 5: ELECTRICAL INSTALLATIONS**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing, Types of Batteries, Characteristics of Batteries. Elementary calculations for energy consumption, power factor improvement, battery backup.

**TEXT BOOK/ REFERENCES:**


1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. Vincent Del Toro, "Electrical Engineering Fundamentals", Pearson, 2015.


**COURSE OUTCOMES:**

At the end of the course, Student will be able to

CO1. To recall fundamental concepts of electrical circuits such as charge, voltage, current and power.
CO2. Describe the principle of operation of D.C. & A.C. machines.
CO3. Outline the working operation of various generating stations.
CO4. Explain the procedure for solving circuits with A.C and D.C. Excitation
CO5. Summarize the performance characteristics of different machines.
CO6. Explain about different equipment used in power industry
CO7. Apply the fundamental laws, associated with Basic Electrical Engineering to solve real world problems in the field of Engineering

CO/PO Mapping

| CO / PO mapping | Program Outcomes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 |
| To recall fundamental concepts of electrical circuits such as charge, voltage, current and power. | 3 | 3 | 1 | 1 | | | 3 | | | 1 | | | 1 | 1 |
| Describe the principle of operation of D.C. & A.C. machines. | 3 | 2 | 2 | 2 | 2 | | | | | 1 | | | 1 | 1 |
| Outline the working operation of various generating stations. | 3 | 3 | 3 | 1 | 1 | | 1 | | | 1 | | | 1 | 1 |
| Explain the procedure for solving circuits with A.C and D.C. Excitation | 3 | 3 | 2 | 1 | 1 | | 2 | | | 1 | | | 1 | 1 |
| Summarize the performance characteristics of different machines. | 3 | 3 | 2 | 1 | 1 | 3 | 1 | | | 1 | | | 1 | 1 |
| Explain about different equipment used in power industry | 3 | 3 | 2 | 1 | | 2 | 2 | | | 1 | | 1 | 3 | 2 |
| Apply the fundamental laws, associated with Basic Electrical Engineering to solve real world problems in the field of Engineering | 3 | 3 | 3 | 3 | 3 | 2 | 2 | | | 2 | | 3 | 3 | 3 |

| | |
|---|---|
| Course designed by | Department of Electrical & Electronics Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29.06.19 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

## Basic Electrical Engineering Laboratory

LIST OF EXPERIMENTS

Basic safety precautions, Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope, resistors, capacitors and inductors.

1. Verification of Kirchhoff laws.
2. Verification of Network Theorems.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. Predetermination of performance parameters of 1 – Phase Transformer.
6. I – V Characteristics of Solar PV cell
7. Brake test on DC Shunt Motor.
8. Measurement of earth resistance.
9. Measurement of reactive power in three phase balanced circuit.
10. Measurement of Choke coil parameters
11. Brake test on 3 - Phase Induction Motor.
12. Determination of AC quantities using CRO/DSO.
13. I – V characteristics of battery.

**COURSE OUTCOMES:**

At the end of the course, Student will be able to

CO 1. Identify common electrical equipment used in laboratory.(L1)

CO 2. Estimate the ratings of different equipment used to perform an experiment. (L2)

CO 3. Demonstrate the usage of various electrical measuring instruments.(L3)

CO 4. Analyze the characteristics of rotating & stationery electrical machines (L4).

CO 5. Interpret the characteristics of PV cell and Battery.(L5)

CO/PO Mapping

| CO / PO Mapping | Program Outcomes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 |
| Identify common electrical equipment used in laboratory. | 3 | | 1 | 1 | 3 | 1 | | | 3 | 2 | 2 | 2 | 2 | 1 |
| Estimate the ratings of different equipment used to perform an experiment. | 3 | 2 | 3 | 3 | 3 | 2 | 1 | | 3 | 3 | 2 | 2 | 2 | 3 |
| Demonstrate the usage of various electrical measuring instruments. | 2 | 2 | 2 | 2 | 3 | 1 | | | 3 | 3 | 1 | 2 | 2 | 1 |
| Analyze the characteristics of rotating & stationery electrical machines. | 3 | 3 | 3 | 3 | 2 | | | | 3 | 3 | | 2 | 3 | 2 |
| Interpret the characteristics of PV cell and Battery. | 3 | 3 | 3 | 3 | 3 | | 1 | | 3 | 3 | 2 | 2 | 3 | 3 |

| | |
|---|---|
| Course designed by | Department of Electrical & Electronics Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29.06.19 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2MEW201 | SEMESTER - I | L | T | P | C |
|---|---|---|---|---|---|
| | WORKSHOP | - | - | 3 | 2 |
| | Total Contact Hours – 36 | | | | |

## LIST OF EXPERIMENTS

1. Assembly and Disassembly of Bicycle ( Fitting)
2. Assembly and Disassembly of Two Wheeler Engine- using power tools ( Fitting)
3. Load Estimation for house appliances, Different types of Electric wire specifications, Design of earth pit, Selection of wires and Switch gears.
4. Foundry practice: ( Pattern design, Mold making and Casting demonstration )
5. Welding: (Arc welding, Transformer selection and connections, Different "G" position welding. Gas welding)
6. Machine Shop : Turning, Milling, Grinding

**TEXT BOOKS:**


1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.


**REFERENCE BOOKS:**


1. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.


**COURSE OUTCOMES:**

After completion of this course, the student will be able to

CO1. Identify and overhaul the components of Bicycle/ Two Wheeler Engine.
CO2. Identify the elements of casting, pattern making and prepare a mould for a single piece and split piece pattern.
CO3. Know the specifications, cutting parameter and perform drilling, milling and grinding operations.
CO4. Know the specifications, welding parameters and perform arc welding and gas welding.
CO5: Calculate load for required electrical design and select correct specifications of electrical requisites.

**CO/PO Mapping**

| Course Title: | Workshop | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2MEW201 | | | | | | | | | | | | | |
| Course Designed by | Dept. of Mechanical Engineering | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | | | | 3 | 1 | | 1 | 3 | 2 | 2 | 2 | 3 | 2 |
| CO2 | 3 | | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 3 | 3 |
| CO3 | 3 | | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 3 | | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |

| Course designed by | DEPARTMENT OF MECHANICAL ENGINEERING |
|---|---|
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2EHA701 | SEMESTER - I | L | T | P | C |
|---|---|---|---|---|---|
| | CONSTITUTION OF INDIA | 2 | - | - | 0 |
| | Total Contact Hours – 30 | | | | |

**SYLLABUS**

**UNIT – I: HISTORY OF MAKING OF THE INDIAN CONSTITUTION**
History - Drafting Committee, (Composition & Working)

**UNIT – II: PHILOSOPHY OF THE INDIAN CONSTITUTION:** Preamble - Salient Features

**UNIT-III: CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES:** Fundamental Rights -Right to Equality -Right to Freedom -Right against Exploitation -Right to Freedom of Religion -Cultural and Educational Rights -Right to Constitutional Remedies ; Directive Principles of State Policy ; Fundamental Duties.

**UNIT-IV: ORGANS OF GOVERNANCE:** Parliament -Composition - Qualifications and Disqualifications - Powers and Functions - Executive - President - Governor - Council of Ministers; Judiciary, Appointment and Transfer of Judges, Qualifications.
**UNIT – V: LOCAL ADMINISTRATION:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat : Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

**TEXT BOOK:**
Reference Source compilation

**REFERENCES:**
**1.** The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

**COURSE OUTCOMES:**

| | |
|---|---|
| CO1. | Students will be able to discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics. |
| CO2. | Students will be able discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India. |
| CO3. | Students will be able to discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP]under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. |
| CO4. | Students will be able to discuss the passage of the Hindu Code Bill of 1956. |
| CO5. | Students will be able to discuss the powers of Executive, Judiciary and Legislature. |

CO/PO Mapping

| Course Title: | Constitution of India (Common to ALL Branches) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2EHA701 | | | | | | | | | | | | | |
| Course Designed by | Dept. of English & Humanities | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | 2 | | | | | | | | |
| CO2 | | | | | | 2 | | | | | | | | |
| CO3 | | | | | | 2 | | | | | | | | |
| CO4 | | | | | | 2 | | | | | | | | |
| CO5 | | | | | | 2 | | | | | | | | |

| | |
|---|---|
| Course designed by | DEPARTMENT OF ENGLISH & HUMANITIES |
| Approval | Approved by: Meeting of Board of Studies held on 23.06.15 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

*** * ***

| A2MAT102 | SEMESTER - II | L | T | P | C |
|---|---|---|---|---|---|
| | MATHEMATICS-II (CIV, EEE, MEC, ECE & CHE) | 3 | 0 | - | 3 |
| | Total Contact Hours – 48 | | | | |

## SYLLABUS

**UNIT-I: NUMERICAL METHODS-1**

Solving Algebraic and Transcendental Equations: Intermediate value theorem (statement), solution concepts, error in solution, measure of accuracy, approximate and exact solutions, Solution methods: Bisection method, Regula-Falsi method and Newton-Raphson Iterative method; Finite differences: Forward, backward and shift operators, relations among operators, Interpolation: Interpolation and extrapolation, data of equal and unequal intervals, Newton's forward and backward Interpolation formulae, Lagrange's interpolation formula, Fitting polynomials to the data by using Newton's and Lagrange's formulae, Inverse Interpolation by Lagrange's formula.

**UNIT- II: NUMERICAL METHODS-2**

Numerical Integration: Simpson's and Trapezoidal rules, Weddle's and Boole's rules of integrations; Numerical solutions of ordinary differential equations: Concepts of Initial Value Problem, Taylor's series method, Euler's method, Runge - Kutta method of fourth order; Predictor-corrector method: Milne's method to solve initial value problems.

**UNIT-III: MULTIVARIABLE CALCULUS**

Overview: Functions of two variables, limit and continuity, partial derivative and its geometrical meaning; Functions of several variables: Partial differential coefficients of higher order, total derivatives, Chain rules for partial differentiation, partial differentiation of Implicit functions; Jacobians: Jacobian and properties, chain rule, functional dependence, Jacobian of implicit functions

Maxima and Minima: Maxima and minima of a function of two variables, constrained maxima and minima, Lagrange's method of undetermined multipliers.

**UNIT-IV:** PARTIAL DIFFERENTIAL EQUATIONS -FIRST ORDER

Formation of PDEs: Elimination of arbitrary constants, Elimination of arbitrary functions; Solution concepts of PDEs: Complete solution / integral, particular integral, general integral and singular integral, PDEs solvable by direct integration; Linear PDEs of first order (Lagrange's linear equation): Method of grouping and method of multipliers; Nonlinear PDEs of first order: Solution methods of solving PDEs in standard forms I, II, III & IV (as is specified in Text Book 1).

**UNIT-V:** PARTIAL DIFFERENTIAL EQUATIONS -HIGHER ORDER

Homogeneous Linear Partial Differential Equations of second and higher order with constant coefficients: Symbolic form, Rules for finding complementary function, Rules for finding particular integral, working procedure to get complete solution; Solving nonhomogeneous linear PDEs of second and higher order with constant coefficients; Method of separation of variables: concept of boundary value problem, solving boundary value problems by separating variables.

//Topics prefixed with ‘outlines / overview’ are not for assessment//

**TEXT BOOKS:**

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
2. T.K.V. Iyengar et al, Engineering Mathematics, S. Chand Publishers, Revised edition

**REFERENCE BOOKS:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
3. T. Veerarajan, Higher Engineering Mathematics, Tata McGraw-Hill, 2008

**COURSE OUTCOMES: A**t the end of course, students shall be able to

CO1 Recall the concepts of numerical methods.
CO2 Recall the concepts of multivariable calculus.
CO3 Recall solution methods of PDEs.
CO4 Use the concepts of numerical methods to solve equations, do interpolation & numerical integration and also to solve ODEs numerically.
CO5 Use the concepts of multivariable calculus to find maxima & minima of a multivariable function.
CO6 Use solution methods of PDEs to solve BVPs.
CO7 Apply the concepts of numerical methods, multivariable calculus and PDEs to solve real world problems including BVPs.

CO/PO Mapping

| Course Title: | MATHEMATICS-II (CIV, EEE, MEC, ECE & CHE) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2MAT102 | | | | | | | | | | | | | |
| Course Designed by | Dept. of Mathematics | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO2 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO3 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO4 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO5 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO6 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO7 | 3 | 3 | | 2 | | | | | | | 2 | | | |

| Course designed by | DEPARTMENT OF MATHEMATICS |
|---|---|
| Approval | Approved by: Meeting of Board of Studies held on 06.07.2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2PYI101 | SEMESTER – II | L | T | P | C |
|---|---|---|---|---|---|
| | ENGINEERING PHYSICS (COMMON TO CE, ME & CHEM) | 3 | - | - | 3 |
| | Total Contact Hours – 48 | | | | |

## SYLLABUS

**Unit – I: CRYSTALLOGRAPHY [8 hrs]**

Introduction- Crystal systems- Bravais lattices- Packing fractions of simple, body centered, face centered cubic structures - Directions and Planes in crystals- Miller indices- Inter planar spacing- Bragg's Law of X-Ray diffraction- Powder X-Ray diffraction method.

**Unit –II: LASER & FIBER OPTICS [10hrs]**

**LASER:** Introduction- Absorption, Spontaneous and stimulated emission of radiation- Einstein coefficients- Population inversion- Basic components of laser- Nd YAG Laser – $CO_2$ Laser- Applications of LASER.

**FIBER OPTICS:** Introduction- Principle of optical fiber- Numerical Aperture- Acceptance angle- Classification of optic fibers- Applications of fibers.

**Unit-III: ULTRASONICS & ACOUSTICS [10hrs]**

**Ultrasonics**-Introduction- Properties of ultrasonic sounds- Generation of Ultrasonic sounds- Magnetostriction- Piezoelectric effect- Detection- Kunts tube- Converse piezoelectric method- Ultrasonic Nondestructive testing technique (pulse-echo technique under reflection mode)- Applications.

**ACOUSTICS-** Introduction– Reverberation- Reverberation time- Sabines formula for reverberation time- Absorption coefficient and its measurement- Factors effecting acoustic design of hall.

**Unit – IV: THERMODYNAMICS [10hrs]**

Introduction- First Law- Isothermal process- Adiabatic process- Work done- Second Law- Carnot's heat engine- Efficiency- Entropy- Physical significance- Entropy and second law- Temperature entropy diagram- Third Law of Thermodynamics- Applications of thermodynamics.

**Unit – V: PRINCIPLES OF MECHANICS [10hrs]**

Introduction- System of forces- Resultant of coplanar forces- Method of resolution- Parallel forces- Moment of force- Varignon theorem- Force system in space- Friction- Limiting friction & Impending motion- Coulomb's laws of dry friction- Coefficient of friction- Cone of friction- Types of friction (qualitative).

**TEXTBOOKS**

1. Engineering Physics by R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications.

**REFERENCES**

1. RESNICK, HALLIDAY and WALKER, Principles of Physics, Wiley Publishers
2. A.NELSON, Engineering Mechanics: Statics & Dynamics by, Tata Mc Graw Hill Publishers.
3. P.K. NAG, Engineering Thermodynamics, Mc. Graw Hill Publishers

**COURSE OUTCOMES:**

CO1. The student will be able to recognize the underlying principles of crystalline solids, LASER production and Optical fibers

CO2. The student will be able to gain knowledge on the fundamentals of acoustics and production & detection of ultrasonics

CO3. The student will be able to describe the essentials of thermodynamics, force systems and friction.

CO4. The student will be able to understand crystal structures and X-ray diffraction as a tool for crystal structure analysis.

CO5. The student will be able to understand the importance of industrially relevant LASERS, applications of optical fibers and the prominence of ultrasonics in nondestructive testing.

CO6. The student will be able to understand basic processes involved in thermo-dynamical systems and force systems

CO7. The student will have the ability to apply the conceptual knowledge of forces and its related physical quantities in solving engineering problems.

**CO/PO MAPPING**:

| Course Title: | Engineering Physics | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2PYI101 | | | | | | | | | | | | | |
| Course Designed by | Dept. of Physics | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | | | | | | 1 | | | | 1 | | |
| CO2 | 3 | 3 | | | | | | 1 | | | | 1 | | |
| CO3 | 3 | 3 | | | | | | 1 | | | | 1 | | |
| CO4 | 3 | 3 | | | | | | 1 | | | | 1 | | |
| CO5 | 3 | 3 | | | | | | 1 | | | | 1 | | |
| CO6 | 3 | 3 | | | | | | 1 | | | | 1 | | |
| CO7 | 3 | 3 | | | | | | 1 | | | | 1 | | |

| Course designed by | DEPARTMENT OF PHYSICS |
|---|---|
| Approval | Approved by: Meeting of Board of Studies held on 29.06.2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2PYI101 | SEMESTER – II | L | T | P | C |
|---|---|---|---|---|---|
| | ENGINEERING PHYSICS LAB | - | - | 3 | 2 |
| | Total Contact Hours – 42 | | | | |

## LIST OF EXPERIMENTS

| | |
|---|---|
| 1. | Determination of size of the micro dimensional system by Laser diffraction. |
| 2. | Determination of numerical aperture and acceptance angle of the optic fiber. |
| 3. | Determination of lattice constants of the crystal systems. |
| 4. | Verification of laws of transverse vibrations in stretched strings by using Sonometer. |
| 5. | Determination of velocity of ultrasonic sounds in liquids by acoustic grating method |
| 6. | Determination of thermal conductivity coefficient of the disc shaped material. |
| 7. | Determination of specific heat of the given liquid by Newton's law of cooling principle. |
| 8. | Determination of temperature coefficient resistance for the thermistor. |
| 9. | Determination of the static friction coefficient. |
| 10. | Determination of rigidity modulus of the wire shaped material by using Torsional pendulum. |

**TEXTBOOKS:**

1. BALASUBRAMANIAN.S, SRINIVASAN.M..N, A Text book of Practical Physics, S Chand Publishers, 2017

**REFERENCES:**

1. https://vlab.amrita.edu.

**COURSE OUTCOMES:**

CO1. Design experiments to determine the size of the micro-dimensional system and the parameters impelling communication through optic fibre.

CO2. Investigate the powder X-Ray diffraction patterns for crystal structure analysis.

CO3. Design experiments for demonstration of mechanical resonance and determine the velocity of ultrasonic sounds in liquid media.

CO4. Design experiments to determine physiognomies of materials like the thermal conductivity coefficient (*K*), specific heat (s) and temperature coefficient of resistance ($\alpha$).

CO5 Design experiments to determine the mechanical properties like the rigidity modulus ($\eta$) and the static friction coefficient ($\mu_s$).

**CO/PO MAPPING**:

| Course Title: | | | | Engineering Physics Lab | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | | | | A2PYI101 | | | | | | | | | | |
| Course Designed by | | | | Dept. of Physics | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | | | | | | 1 | 2 | 1 | | 1 | | |
| CO2 | 3 | 3 | | | | | | 1 | 2 | 1 | | 1 | | |
| CO3 | 3 | 3 | | | | | | 1 | 2 | 1 | | 1 | | |
| CO4 | 3 | 3 | | | | | | 1 | 2 | 1 | | 1 | | |
| CO5 | 3 | 3 | | | | | | 1 | 2 | 1 | | 1 | | |

| Course designed by | DEPARTMENT OF PHYSICS |
|---|---|
| Approval | Approved by: Meeting of Board of Studies held on 29.06.2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2CII201 | SEMESTER – II | L | T | P | C |
|---|---|---|---|---|---|
| | PROGRAMMING FOR PROBLEM SOLVING | 3 | 0 | 3 | 5 |
| | Total Contact Hours : 54 | | | | |
| | Prerequisites: Mathematics | | | | |

**COURSE OBJECTIVES**

| | |
|---|---|
| **COBJ1.** | Students will study systematic approach to problem solution specification using finite number of unambiguous steps. |
| **COBJ2.** | Students will gain understanding of procedural language features using C as the template. |
| **COBJ3.** | Students will read and analyse alternative construct choices in procedural language C. |
| **COBJ4.** | Students will get exposure to systematic approach of automated solution design, implementation and testing using a procedural language. |

## SYLLABUS

### UNIT – I: [9 HOURS]

**INTRODUCTION:** Introduction to Programming, Computer System, Hardware and Software concepts.

**PROBLEM SOLVING:** Algorithm, Pseudo-code, flow-chart, program development steps, high-level, Assembly and machine languages.

**BASICS OF C PROGRAMMING:** Structure of C program, identifier, basic data types and sizes, constants, variables, arithmetic operators, relational operators, logical operators, increment and decrement operators, assignment operator, conditional operator, scanf and printf built-in functions, Creating and running programs.

### UNIT – II: [9 HOURS]

**BIT-WISE OPERATORS:** logical, shift, rotation, masks.

**EXPRESSIONS:** expressions, type conversions, conditional expressions, precedence and order of evaluation.

**SELECTION:** Two-way selection: if-else, nested if, examples, multi-way selection: switch, else-if, examples.

**ITERATIVE:** loops - while, do-while and for statements, break continue, event and counter controlled loops.

### UNIT – III: [18 HOURS]

**Part – I: [9 HOURS]**

**ARRAYS:** Arrays (1-D, 2-D), Character arrays and Strings, Searching (Linear Search and Binary Search).

**Part – II: [9 HOURS]**

**BASIC ALGORITHMS:** Basic Sorting Algorithms (Bubble, Insertion and Selection), comparing algorithms for complexity.

**FUNCTIONS:** Functions, Scope and Extent of Variables, Function Parameters, parameter passing using call-by-value, sub-routines, Storage Classes,#define,#ifdef, #ifndef pre-processor directives.

## UNIT – IV: [9 HOURS]

**RECURSION:** Definition of Recursion, example programs using recursion like finding Factorial, Fibonacci series, Quick sort, puzzle solving using recursive functions (towers of hanoi, ackerman function).

**POINTERS:** Definition of Pointers, Pointer Type, Pointer Arithmetic, Function parameter passing using call-by-reference.

**MEMORY ALLOCATION:** Difference between static and dynamic memory allocation, dynamic memory allocation using built-in functions, dangling pointer, unreferenced memory problem.

## UNIT – V: [9 HOURS]

**ENUMERATED, STRUCTURE AND UNION TYPES:** Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, bit-fields, concept of linked list, program applications.

**FILE-HANDLING:** Input and output- concept of a file, text files and binary files, Formatted I/O, File I/O operations, command line arguments.

Suggested Text Books


1. Programming For Problem Solving, Behrouz A.Forouzan & Richard F.Gilberg, Cengage Publishers, 3rd Edition
2. Programming In C:A Practical Approach, Ajay Mittal, Pearson Education


Suggested Reference Books


1. Brian W. Kernighan And Dennis M. Ritchie, The C Programming Language, Prentice Hall Of India
2. Introduction To C Programming, Reema Thareja, Oxford University Press
3. E. Balaguruswamy, Programming In Ansi C, Tata Mcgraw-Hill

## COURSE OUTCOMES

The student will

1. Have the ability to **describe** a formal algorithmic solution for the given problem, **list** the features of C including scalar & vector data types, operators, **Outline** expressions, expression evaluation, operator precedence, sequential, conditional & iterative constructs.

2. Have the ability to **describe** one and two-dimensional arrays, **outline** loops and arrays for searching and **describe** various sorting techniques.

3. Have the ability to **outline** the purpose of functions, pointers, command line arguments, dynamic memory allocation. **Define** storage classes. **Describe** command like arguments, structures, unions, and enumeration. Have knowledge of handling files.

4. Have the ability to **solve** complex expressions, **design** algorithms and **develop** programs in C language using the basic constructs, data types, operators, control & iterative statements, and arrays.

5. Have the ability to **apply** arrays to solve complex matrix related problems and strings. **Compare and contrast** various searching and sorting techniques for complexity.
6. Have the ability to **distinguish between** function call types. **Draw inferences on** command line arguments, storage classes, and pre-processor directives. **Use** pointers with functions, arrays, strings, to **solve** complex problems. **Give example** and **solve** classical recursion problems**. Compare and contrast** static and dynamic memory allocation, and **apply** them. **Use** structures and unions to implement and **solve** real-time problems. **Apply** file related functions to process files.

7. Have the ability to **Fully appreciate** the art of procedural programming in C and develop programs **optimally** using the full feature set of C language.

| Course Title: | Programming for problem solving (Common to ALL Branches) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2CII201 | | | | | | | | | | | | | | |
| Course Designed by | Dept. of Computer Science and Engineering | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSOM | PSON | PSOO |
| CO1 | 3 | 3 | | | | | | 3 | 2 | 1 | | 2 | 1 | 1 | 1 |
| CO2 | 3 | 3 | | | | | | 3 | 2 | 1 | | 2 | 1 | 1 | 1 |
| CO3 | 3 | 3 | | | | | | 3 | 2 | 1 | | 2 | 1 | 1 | 1 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 3 | 3 | 3 |
| CO7 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 |

**Levels of Correlation: High-3, Medium-2, Low-1**

## PROGRAMMING FOR PROBLEM SOLVING PRACTICE

| COURSE OBJECTIVES | |
|---|---|
| 1. | To use basic data types, operators, expressions and expression evaluation mechanisms using C Programming Language. |
| 2. | To implement control flows construct in C Programming Language and understand the syntax, semantics and usability contexts of these different construct. |
| 3. | To develop composite data types in C and constructs available to develop their data-types, utilize them to model things and dealing with data from and to external files. |
| 4. | To design programs with different variations of the constructs available for practicing modular programming and understand the pros and cons of using different variants and apply optimization. |

### UNIT – I

**WEEK 1:**

**Objective:** Getting familiar with the programming environment on the computer and writing the first program.

**Suggested Experiments/Activities:**

**Tutorial 1:** Problem-solving using computers

**Lab1:** Familiarization with programming environment

i) Exposure to Turbo C, gcc, Code Blocks IDE
ii) Writing simple programs using printf(), scanf()

**WEEK 2:**

**Objective:** Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

**Suggested Experiments/Activities:**

**Tutorial 2:** Problem-solving using Algorithms and Flow charts

**Lab1:** Converting algorithms/flowcharts into C Source code

Developing the algorithms/flowcharts for the following sample programs

i. Sum and average of 3 numbers
ii. Conversion of Fahrenheit to Celsius and vice versa
iii. Simple interest calculation

**WEEK 3:**

**Objective:** Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

**Suggested Experiments/Activities:**

**Tutorial 3:** Variable types and type conversions:

**Lab 3:** Simple computational problems using arithmetic expressions

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

## UNIT – II

**WEEK 4:**

**Objective:** Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

**Suggested Experiments/Activities:**

**Tutorial 4:** Operators and their precedence and associativity:

**Lab 4:** Simple computational problems using the operator's precedence and associativity

i) Evaluate the following expressions
   a. A+B*C+(D*E)+F*G
   b. A/B*C-B+A*D/3

ii) a. A+++B---A
   b. J=(i++)+(++i)

iii) Find the maximum of three numbers using conditional operator

iv) Take marks of 5 subjects in integers, and find the total, average in float

**WEEK 5:**

**Objective:** Explore the full scope of different variants of "if construct" namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

**Suggested Experiments/Activities:**

**Tutorial 5:** Branching and logical expressions:

**Lab 5**: Problems involving if-then-else structures

i) Write a C program to find the max and min of four numbers using if-else

ii) Write a C program to generate electricity bill

iii) Find the roots of the quadratic equation

iv) Write a C program to simulate a calculator using switch case

v) Write a C program to find the given year is a leap year or not

**WEEK 6:**

**Objective:** Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

**Suggested Experiments/Activities:**

**Tutorial 6:** Loops, while and for loops:

**Lab 6:** Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop

ii) Find the given number is a prime or not

iii) Compute sine and cos series

iv) Checking a number palindrome

v) Construct a pyramid of numbers

## UNIT – III

**WEEK 7:**

**Objective:** Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

**Suggested Experiments/Activities:**

**Tutorial 7:** 1D Arrays: searching

**Lab 7:** 1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array
ii) Perform linear search on1D array
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number
v) Eliminate duplicate elements in an array

**WEEK 8:**

**Objective:** Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

**Suggested Experiments/Activities:**

**Tutorial 8:** 2D arrays, Sorting and Strings

**Lab 8:** Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

## UNIT-IV

**WEEK 9:**

**Objective:** Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

**Suggested Experiments/Activities:**

**Tutorial 9:** Functions, call by value, scope and extent,

**Lab 9:** Simple functions using call by value, Solving differential equations using Eulers theorem

i) Write a C function to calculate NCR value
ii) Write a C function to find the length of a string
iii) Write a C function to transpose of a matrix
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

**WEEK 10:**

**Objective:** Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

**Suggested Experiments/Activities:**

**Tutorial 10:** Recursion, the structure of recursive calls
**Lab 10:** Recursive functions

i) Write a recursive function to generate Fibonacci series
ii) Write a recursive function to find the lcm of two numbers
iii) Write a recursive function to find the factorial of a number
iv) Write a C Program to implement Ackermann function using recursion
v) Write a recursive function to find the sum of series.

**WEEK 11:**
**Objective:** Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers
**Suggested Experiments/Activities:**
**Tutorial 11:** Call by reference, dangling pointers
**Lab 11:** Simple functions using Call by reference, Dangling pointers

i) Write a C program to swap two numbers using call by reference
ii) Demonstrate Dangling pointer problem using a C program
iii) Write a C program to copy one string into another using pointer
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

**UNIT – V**

**WEEK 12:**
**Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc(), calloc(), realloc() and free() functions. Gain experience processing command-line arguments received by C

**Suggested Experiments/Activities:**
**Tutorial 12:** Pointers, structures and dynamic memory allocation
**Lab 12:** Pointers and structures, memory dereference

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

**WEEK 13:**
**Objective:** Experiment with C Structures, Unions, bit fields and self-referential structures (Singly-linked lists) and nested structures
**Suggested Experiments/Activities:**
**Tutorial 12:** Bitfields**,** Self-Referential Structures, Linked lists
**Lab 12:** Bitfields, linked lists

i) Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields
ii) Create and display a singly linked list using self-referential structure
iii) Demonstrate the differences between structures and unions using a C program
iv) Write a C program to shift/rotate using bitfields
v) Write a C program to copy one structure variable to another structure of the same type.

**WEEK 14:**
**Objective:** To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.
**Suggested Experiments/Activities:**
**Tutorial 14:** File handling:
**Lab 14:** File operations

i) Write a C program to write and read text into a file
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file
iv) Write a C program to merge two files into the third file using command-line arguments
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

**TEXTBOOKS:**

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

**REFERENCES:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

**COURSE OUTCOMES**

| | |
|---|---|
| CO1. | **Demonstrate** the ability to write a formal algorithmic solution for the given problem, **name & explain** the features of C like types including scalar & vector types, operators, expressions, expression evaluation, operator precedence, sequential, conditional & iterative constructs. |
| CO2. | **Implement** one and two-dimensional arrays to solve simple mathematical and matrix related problems. **Make use of** loops and arrays for searching and **Compare** various sorting techniques. |
| CO3. | **Identify** the purpose of functions, pointers, command line arguments, dynamic memory allocation. **Define** storage classes. **Understand** command like arguments, structures and unions. Have **knowledge** of handling files. |
| CO4. | **Design** algorithms and **develop** programs in C language using the basic constructs, data types, operators, control statements, and arrays. |
| CO5 | **Apply** pointers, functions, derived data types, and dynamic memory allocation, **design** solutions to challenging problems. |
| CO6 | **Illustrate** the art of procedural programming in C and **develop** programs optimally using the full feature set of C language. |

| Course Title: | Programming for problem solving lab |
|---|---|
| Course Code: | A2CII201 |
| Course Designed by | Dept. of CSE & IT |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 2 | 3 | 1 | 1 | 1 | 2 | 2 | | | 2 | 2 | 2 |
| CO2 | 3 | 3 | 1 | 2 | 3 | 1 | 1 | 1 | 2 | 2 | | | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | | | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | | | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | | | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | | 3 | 3 | 3 |

Levels of Correlation: High-3, Medium-2, Low-1

| | |
|---|---|
| Course designed by | DEPARTMENTS OF CSE & IT |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019 |

| A2EHL001 | SEMESTER - II | L | T | P | C |
|---|---|---|---|---|---|
| | Essential Communication in English | 1 | - | 3 | 3 |
| | Total Contact Hours – 60 | | | | |

## SYLLABUS

**UNIT – I: BASIC LANGUAGE SKILLS – A REFRESHER**

**Organs of Speech:** Consonant Sounds &Vowel Sounds; Phonemic Transcription; Using a Dictionary to know the Pronunciation of a word

**Presenting Oneself**: Introducing oneself -Using different expressions in Formal&Informal Contexts.

**Reading a News Article**: Identifying the key words and their usage; summarizing the information

**Word Study & Mind Mapping:** Root words–Derivatives; Homonyms, Homographs, Homophones; Synonyms & Antonyms

**UNIT – II: RUDIMENTS OF FUNDAMENTAL COMMUNICATION**

**The World:** Listening & watching Documentaries on World famous Places.

**Describing People, Places and Life experiences:** Physical Description- Describing someone's qualities – Usage of Jargon to present topography.

**Short Story Corner:** Reading a short story – Understanding the mood and essence – Sharing different perspectives.

**Sentence Patterns:** Concord – Rules – Common errors in day-day usage

**UNIT-III: COMMUNICATION AT PRACTICE**

**Oratory Skills:** Listening to World's Famous Speeches

**JAM (Just a Minute) Talk:** Format & Delivery Techniques

**Nuances of Language:** Company Description –Position Description (Formal) – processes like Chocolate Making( Informal)**.**

**Types of Sentences** – Declarative, Interrogative, Assertive etc.

**UNIT-IV: COMMUNICATION THROUGH CONCEPTUAL LEARNING**

**BBC English:** Watching interviews of Famous people.

**Dialogue Practice:** Situational Dialogues; Structuring a Role Play

**New Inventions:** Reading about latest technology pertaining to different fields (Source : Science Journals)

**Transformation of sentences:** Active Voice-Passive Voice**,** Direct & Indirect Speech**,** Degrees of Comparison**,** Simple Compound & Complex Sentences.

**UNIT – V: COMMUNICATION THROUGH LIFE SKILLS**

**Watching Movies for Language Enrichment & Writing Reviews.**

**Skits:** Enacting a Skit on a Social Issue

**Reflections:** Reading News Paper Editorial columns, Literacy Reviews, Poetry

**Presenting an autobiography:** Exploring different styles of writing autobiographies and evolving an own style**.**

**TEXT BOOK:**
Reference Source Compilation by the Department

**REFERENCES:**
1. **Fundamentals of Technical Communication** by Meenakshi Raman,OUP.
2. **Living English Structure** by W.Stannard Allen, Pearson Publications.
3. **English Made Easy** by Mary Margaret Hosler, Mc Graw Hill.
4.. **English and Communication Skills for Students of Science and Engineering**, by Dhanavel, S.P. Orient Blackswan Ltd.
5. **The Oxford Guide to Writing and Speaking** by John Seely , OUP

**COURSE OUTCOMES:**

CO1. Student will be able to come to terms with the basic language Skills required to cater to the requirement of the programme undertaken.

CO2. Student will be able to comprehend and analyze the core concepts well.

CO3. Student will be able to gain proficiency in all four skills of Language – Listening, Reading, Speaking and Writing.

CO4. Student will be able to understand the Syntactical and Grammatical Components of English Language and their correct use.

CO5: Student will be able to present his/her ideas confidently in a Professional manner.

CO/PO Mapping

| Course Title: | **Essential Communication in English** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2EHL001 | | | | | | | | | | | | | |
| Course Designed by | Dept. of English & Humanities | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| CO2 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| CO3 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| CO4 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| CO5 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |

| Course designed by | DEPARTMENT OF ENGLISH & HUMANITIES |
|---|---|
| Approval | Approved by: Meeting of Board of Studies held on 29.06.19 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2MED201 | SEMESTER - II | L | T | P | C |
|---|---|---|---|---|---|
| | COMPUTER AIDED ENGINEERING GRAPHICS | 1 | - | 3 | 3 |
| | Total Contact Hours – 60 | | | | |

## SYLLABUS

**UNIT-I**

**Overview of Computer Graphics:**

Computer technologies that impact on graphical communication, Demonstrating knowledge of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line, The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

Set up of the drawing page and the printer, Scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing.

Applying dimensions to objects, applying annotations to drawings;

**UNIT-II**

**Layers:** Setting up and use of Layers, layers to create drawings, create, edit and use customized layers, concept of view ports.

**Introduction to Orthographic Projections**: Projections of Points; Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane.

**UNIT-III**

**Projections of Straight Lines and Planes:** Lines inclined to both planes, determination of true lengths, angle of inclinations and traces, Projections of Planes

**UNIT-IV**

**Projections and sections of solids:** Projections of simple solids- Sections of solids

**UNIT -V**

**Development of surfaces, Isometric Projection and Conversion of Isometric Views to Orthographic Views:** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa

**TEXT BOOKS**

1. DM Kulkarni, AP Rastogi, AK Sarkar "Engineering graphics with Auto CAD" PHI Publishers
2. Bhatt N.D., Panchal V.M. & Ingle P.R "Engineering Drawing" Charotar Publishing House.

**REFERENCE BOOKS**

1. Shah, M.B. & Rana B.C "Engineering Drawing and Computer Graphics", Pearson Education.
2. Agrawal B. & Agrawal C. M "Engineering Graphics", TMH Publication.
3. Narayana, K.L. & P Kannaiah "Engineering Drawing", SciTech Publishers.
4. CAD Software Theory and User Manuals.

**COURSE OUTCOMES**

At the end of the course the students will be able to:

CO1: Prepare two dimensional drawings using draw and modify commands in Auto CAD software and represent dimensions to the drawings

CO2: Clearly differentiate different types of projections and get solutions to projections of points in Auto CAD by applying the layers concept

CO3: Solve problems related to projections of straight lines and planes

CO4: Prepare simple solids in CAD software and obtain solutions to projections and sections of solids

CO5: Develop the surfaces of simple solids, prepare Isometric drawings and convert isometric drawings into orthographic views

**CO/PO Mapping**

| Course Title: | Computer Aided Engineering Graphics | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2MED201 | | | | | | | | | | | | | |
| Course Designed by | Dept. of Mechanical Engineering | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 2 | | 3 | 1 | | 1 | 2 | 3 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | | 3 | 1 | | 1 | 2 | 3 | | | 2 | 1 |
| CO3 | 3 | 2 | 2 | | 3 | 1 | | 1 | 2 | 3 | | | 2 | 1 |
| CO4 | 3 | 2 | 3 | | 3 | 1 | | 1 | 2 | 3 | 2 | 2 | 3 | 1 |
| CO5 | 3 | 2 | 3 | | 3 | 1 | | 1 | 2 | 3 | 2 | 2 | 3 | 1 |

| Course designed by | DEPARTMENT OF MECHANICAL ENGINEERING |
|---|---|
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

* * *

| A2EHT001 | SEMESTER - III | L | T | P | C |
|---|---|---|---|---|---|
| | **EFFECTIVE TECHNICAL COMMUNICATION** (Skill Oriented Course) | **2** | **-** | **2** | **3** |
| | **Total Contact Hours – 48** | | | | |

## SYLLABUS

### UNIT – I: PROFICIENCY SKILLS IN COMMUNICATION

**Listening Comprehension (Basic Level)**:

- Working memory – attention –Vocabulary – Inference- comprehension monitoring.

**Elocution**:

- Composition of words in phrases and clauses – Collocation of words – patterns of sentences – proper use of conjunctions.

**Reading Comprehension Practice – I:**

- Reading Passages for Enrichment of Vocabulary and Sentence Improvement.

**Sentence Completion:**

- Concepts &Rules

### UNIT – II: COMMUNICATION FOR COMPETITIVE WORLD

**Listening Comprehension- (Advanced)**:

- TOEFL – GRE - IELTS Orientation, Mock Tests.

**Group Discussion**:

- Purpose – Planning –Participation. Etiquette – reaching consensus in group work

**Reading Comprehension Practice – II:**

- Skimming & Scanning Techniques

**Idiomatic expressions & Foreign Expressions and their usage**

### UNIT-III: COMMUNICATION FOR PROFESSIONAL OUTREACH

**Interview Skills:**

- Watching Mock Interviews**,** Interview Training Sessions,

**Mock Interviews:**

- Facing Interviews, Prerequisites and practice

**Cloze Passages:**

- Reading &Understanding the sequence of sentences in passages

**Syllogisms**:

- Major Premise – Minor premise – Conclusion

**Analogies**:

- Types of Analogies

**UNIT-IV: CAREER PLANNING & GUIDANCE**

**Video Profile:**

- Preparation – Planning - Execution

**Presentation Skills:**

- Making an oral Presentation -Structuring ideas – Power Point Presentation etiquette –Practice

**Reading Comprehension – III (Practice)**

- (Passages culled from model papers of competitive and qualifying examinations)

**Resume Writing & Cover Letter writing**

**UNIT – V: ENGLISH & PROFESSIONAL ETIQUETTE**

**Learning through Visuals:**

- Body Language Gestures & Postures.

**Debating Skills:**

- Making an opening statement – rebuttals – Closing statement**,** Debate etiquette

**Logic based English Language Tests – Practice**

**Report Writing:**

- Types of Reports – Writing a Technical Report

**TEXT BOOK:**

Open Source Compilation

**REFERENCES:**


1. Basic Communication Skills for Technology by Andrea J.Rutherfoord, Pearson Publications.
2. Business Communication Today Courtland L. Bovee,John V.Thill Abha Chatterjee, Pearson Publications.
3. How to Do Well in GDs and Interviews by Pearson Publications.

**COURSE OUTCOMES:**

CO1. Student will be able to develop proficiency in Communication in English.

CO2. Student understands the structure and pattern of various competitive and qualifying examinations for higher studies and employment.

CO3. Student will be able to express professionally his/her views to the context.

CO4. Student will be able to understand the need and concept of professional etiquette as a prerequisite for written and spoken communication.

CO5. Student shall be able to hone his/her analytical thinking skills.

CO6. Student will be able to acquire the employability skills needed.

CO/PO Mapping

| Course Title: | **Effective Technical Communication** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | **A2EHT001** | | | | | | | | | | | | | |
| Course Designed by | Dept. of English & Humanities | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| CO2 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| CO3 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| CO4 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| CO5 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |
| C06 | | | | | | 2 | | 2 | 3 | 3 | | 3 | | |

| Course designed by | DEPARTMENT OF EHGLISH & HUMANITIES |
|---|---|
| Approval | Approved by: Meeting of Board of Studies held on 29.06.19 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2EHT002 | SEMESTER - III | L | T | P | C |
|---|---|---|---|---|---|
| | **Professional Ethics and Human Values** | 2 | 1 | 0 | 3 |
| | **Total Contact Hours : 48** | | | | |
| | **Prerequisite : UHV** | | | | |

**UNIT I: Need, Basic Guidelines, Content and Process for Value Education**

Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration, Its content and process; 'Natural Acceptance' and Experiential Validation, Continuous Happiness and Prosperity, Right understanding, Relationship and Physical Facility, Understanding Happiness and Prosperity correctly, Method to fulfil the above human aspirations

**UNIT II: Understanding Harmony in the Human Being - Harmony in Myself**

Human being as a co-existence of the sentient 'I' and the material 'Body, needs of Self ('I') and 'Body', Body as an instrument of 'I', characteristics and activities of 'I' and harmony in 'I', harmony of I with the Body, Programs to ensure Sanyam and Health.

**UNIT III:**

**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**

Human-human relationship; meaning of Justice, nine universal values in relationships, Trust and Respect as the foundational values of relationship, Understanding the harmony in the society, Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Undivided Society, Universal Order- from family to world family

**Harmony in the Nature and Existence**

Harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature, Understanding Existence as Co-existence, Holistic perception of harmony at all levels of existence

**UNIT IV:**

**Engineering Ethics & Engineers Rights and Responsibilities**

The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics- Professional and Professionalism –Professional Roles to be played by an Engineer –Professional Ethics-Types of Inquiry .Safety and Risk, Concept of Safety – Types of Risks - Designing for Safety – Risk- Benefit Analysis-Accidents- Professional Rights and Responsibilities – confidential and proprietary information-Loyalty-Conflict of Interest–Occupational Crimes-industrial espionage-price fixing-endangering lives- Whistle Blowing-types of whistle blowing- Case Studies

**UNIT V: Global Issues and IPR**

Globalization- Cross-culture Issues- Ethics and Research-Analyzing Ethical Problems in Research-Intellectual Property Rights- Intellectual Property Law- Copyright-principles-Rights-infringement - Law- Patent – stages-infringement- Law- Case Studies.

*Include practice exercises and case studies will be taken up in practice sessions (tutorial hours)
Ex. To discuss the conduct as an engineer or scientist etc.

**Text Books**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

| **COURSE OUTCOMES** | |
|---|---|
| 1. | Knowledge of happiness, prosperity, natural acceptance and harmony |
| 2 | Knowledge of harmony in the human being, family, society and nature/existence |
| 3. | Knowledge of professional ethics and global issues & IPR |
| 4. | Understand happiness, prosperity, natural acceptance and harmony |
| 5 | Understand harmony in the human being, family, society and nature/existence |
| 6. | Understand the professional ethics, global issues and IPR |
| 7. | Apply universal values and ethics in all spheres of life |

| A2EHT002 & Professional Ethics And Human Values | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | | | | | | | | | | | | | | |
| CO / PO mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | 1 | | | 2 | | 3 | 1 | | | | 1 | |
| CO2 | | | 1 | | | 2 | | 3 | 1 | | | | 1 | |
| CO3 | | | 1 | | | 2 | | 3 | 1 | | | | 1 | |
| CO4 | | | 1 | | | 2 | | 3 | 1 | | | | 1 | |
| CO5 | | | 1 | | | 2 | | 3 | 1 | | | | 1 | |
| CO6 | | | 1 | | | 2 | | 3 | 1 | | | | 1 | |
| CO7 | | | 1 | 3 | | 2 | | 3 | 1 | | | | 1 | |

| A2EHT002 & Professional Ethics And Human Values | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2CHT101 | SEMESTER – III | L | T | P | C |
|---|---|---|---|---|---|
| | **Biology for Engineers** | **3** | **0** | **0** | **3** |
| | Total Contact Hours – 48 | | | | |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To understand the biological concepts from an engineering perspective |
| 2 | To study the importance of chemicals like lipids, sugars, polysaccharides, amino acids and proteins |
| 3 | To understand about DNA and RNA |
| 4 | To understand the process of metabolism |
| 5. | To understand the various applications of industrial enzymes |
| 6. | To understand the importance of industrial microbiology in the current scenario |
| 7. | To understand the importance of microbes and its applications |

**Syllabus:**

**UNIT-I:**
**Introduction**: Biology and its applications, Biological classification, Living Organisms: Cells and Cell theory, Cell structure and function.

**UNIT-II:**
**Biochemistry and molecular analysis:** Chemical composition of living forms, analysis of Chemical composition, Carbohydrates, Amino acid and proteins, protein synthesis, Nucleic acids, lipids, nature of bonding and qualitative tests.

**Unit-IIIA**:
**Genetics:** Transfer of genetic information, Mendelian Law, Mendel's law of inheritance, Gene interaction, multiple allens, chromosome theory of inheritance., linkage, Recombination, Chromosome mapping, Genetic disorders, Nucleic acids, replication of DNA, types of RNA, Transcription, Genetic code, translation and steps in translation.

**Unit-IIIB**:
**Metabolism:** Thermodynamics as applied to biological systems. Exothermic and endothermic reactions. Concept of Keq and its relation to standard free energy, Spontaneity. ATP as an energy currency. The breakdown of glucose to$CO_2$ + $H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from $CO_2$ and $H_2O$ (Photosynthesis). Energy yielding and energy consuming reactions, Concept of Energy charge.

**UNIT-IV**:
**Enzymes and industrial applications**: Mode of action of enzymes, properties of enzymes, chemical reactions, factors affecting enzyme activity, Co-factors, importance of enzymes, industrial application of enzymes.

**UNIT-V:**
**Microbiology and Industrial applications:** Microorganism, Growth kinetics, culture media, sterilization, Microscopy, application of microbiology, immunology and immunity, Cancer Biology, stem cells.

**Course Outcomes:**

Students will be able to:

1. Explain the importance of biology in engineering.
2. Identify the importance of chemicals like lipids, sugars, polysaccharides, amino acids and proteins
3. Know the importance of DNA and RNA
4. Describe the process metabolism
5. Know the various applications of industrial enzymes
6. Know the importance of industrial microbiology in the current scenario.
7. Explain importance of the microbes and its applications.

**Text books:**

1. Biology for Engineers by Wiley (ISBN: 9781121439931), 1st edition TMH, New Delhi (2019)
2. Suraish kumar G K, Biology for Engineers, Oxford University Press, New Delhi (2019)

**References:**


1. Campbell, NA and Reece JB, Biology, International edition, 7th edition or later, Benjamin Cummings, New York (2007 or later)
2. Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013)


**Mapping of POs & COs (Program Outcomes & Course Outcomes)**

| **A2CHT101 Biology for Engineers** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 |
| CO-1 | 2 | | | 2 | | | | 2 | 2 | | 2 | 2 | 2 | |
| CO-2 | 2 | | | | | | | | | | | | 2 | |
| CO-3 | 2 | | | | | | | | | | | | 2 | |
| CO-4 | 2 | | | | | | | | | | | | 2 | |
| CO-5 | 2 | | | | | | | | | | | | 2 | |
| CO-6 | 2 | | | 2 | | | | 2 | 2 | | 2 | 2 | 2 | |
| CO-7 | 2 | | | | | | | | | | | | 2 | |

| **A2CHT101 Biology for Engineers** | |
|---|---|
| Course designed by | Department of Chemical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29th Jun, 2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13th AUG, 2020 |

| A2MAT106 | SEMESTER - III | L | T | P | C |
|---|---|---|---|---|---|
| | MATHEMATICS-III (common to CIV & MEC) | 3 | 0 | - | 3 |
| | Total Contact Hours – 48 | | | | |

**Syllabus**

**Unit-I: Random Variables & Probability Distributions** **09 Hours**

Random Variables: Discrete and continuous random variables, properties of mass and density functions. Mathematical Expectation: Properties (statements), Moment Generating Function; Outlines: of Binomial and Poission distributions; Normal Distribution: Probability density function, Normal approximation to Binomial Distribution, Parameters of Normal Distribution(statements), Characteristics of normal distribution, Area under normal curve, Standard normal distribution.

**Unit-II: Statistical Methods** **08 Hours**

Curve fitting by least squares method: Bi-variate data, scatter diagram, method of least squares, normal equations, fitting of straight line, second degree curve (parabola), exponential and power curves; Correlation: types of correlation, measures of correlation, Karl Pearson coefficient of correlation and its properties; Regression Analysis: Regression Coefficients and its Properties, Regression lines.

**Unit-III: Multiple Integrals** **07 +07 Hours**

Double Integral: Concept of double integration, properties, evaluation procedures, change of order of integration, double integrals in polar coordinates; Change of variables: Jacobian of transformations, Change of Cartesian coordinates to polar coordinates in double integrals, Applications of double integrals: Calculation of areas enclosed by plane curves (Cartesian and polar coordinates);

Triple Integrals: Evaluation procedures of triple integrals; Change of variables: Jacobian of transformations, Change of rectangular coordinates to Cylindrical and Spherical polar coordinates in triple integrals; Applications of triple integrals: Volumes of solids.

**Unit-IV: Differential Calculus of Vectors** **08 Hours**

Gradient: Scalar and vector point functions, scalar and vector fields, vector operator 'del', Gradient of a scalar point function (GradΦ), geometrical interpretation of GradΦ, directional derivative, maximum directional derivative, evaluation of scalar potential of an irrotational field; Divergence: Divergence of a vector point function, physical interpretation of divergence, solenoidal vector function; Curl: Curl of a vector point function, physical interpretation of curl, Rotational and Irrotational fields.

**Unit-V: Integral Calculus of Vectors** **09 Hours**

Line integral of a vector function: Line integral and its types, applying line integral to calculate 'circulation' of a fluid particle and total work done by a force; Surface integral of a vector function: Surfaces, types of surfaces, surface integral and its types, evaluation of surface integrals; Volume integral of a vector function: Evaluation of volume integrals; Integral theorems relating line, surface and volume integrals: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem (all statements), Verification of theorems.

//Topics prefixed with 'Outlines' are not for assessment//

**Text Books**:

TB1 B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017

TB2 T.K.V. Iyengar et al, Engineering Mathematics, S. Chand Publications, Revised edition .

**Reference Books**:

RB1 Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

RB2 B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th Reprint, 2010.

RB3 Murugesan and Gurusamy, Probability, Statistics and Random Process, Anuradha Publicatons.

**Course Outcomes**

At the end of the course, students shall be able to:

| | | |
|---|---|---|
| CO 1 | KO#1 | Recall the concepts of Random Variables, Probability Distributions, Curve Fitting and Correlation, Regression |
| CO 2 | KO#2 | Recall the concepts of Multiple Integrals |
| CO 3 | KO#3 | Recall the concepts of Vector Calculus |
| CO 4 | UO#1 | Use and Interpret the concepts of Random Variables, Probability Distributions, Curve Fitting and Correlation, Regression |
| CO 5 | UO#2 | Use and interpret the concepts of Multiple Integrals |
| CO 6 | UO#3 | Use and interpret the concepts of Vector Calculus |
| CO 7 | AO#1 | Apply the concepts of Probability Distributions, Statistical Methods, Multiple Integrals and Vector Calculus to model and solve real world problems. |

**CO/PO Mapping**

| | |
|---|---|
| Course Title: | Mathematics-III (MEC & CIV) |
| Course Code: | A2MAT106 |
| Course Designed by | Dept. of Mathematics |

| CO | Program Outcome (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| 2 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| 3 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| 4 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| 5 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| 6 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| 7 | 3 | 3 | | 2 | | | | | | | 2 | | | |

| | |
|---|---|
| Course Designed by | Dept. of Mathematics |
| Approval | Approved by Board of Studies (BoS) of Department of Mathematics in its 4th meeting held on 06.07.2019 |
| | Ratified by Academic Council in its 5th meeting held on 13.07.2019. |

| A2MET301 | SEMESTER - III | L | T | P | C |
|---|---|---|---|---|---|
| | ENGINEERING MECHANICS | 3 | - | - | 3 |
| | **Total Contact Hours – 48** | | | | |

**SYLLABUS**

**UNIT-I Introduction to Engineering Mechanics and System of Forces:**

**Coplanar force systems**: Coplanar forces and its Resultant, Free body diagram, Particle equilibrium and Rigid Body equilibrium; Equilibrium of Coplanar Forces, Moment of Force and its Application, Couples, Types of beams, Static indeterminacy

**Non Coplanar/spacial force systems:** Components in space, Resultant of spacial force systems, Equilibrium of spacial force Systems in space

**UNIT II Basic Structural Analysis & Friction:**

**Trusses**: Types of plane trusses, Perfect plane Trusses, How to determine if a member is in tension or compression; Method of Joints, Method of Sections, Zero force members;

**Friction:** Types of friction, Limiting friction, Laws of Friction, Impending Motion, wedge friction, Ladder friction.

**UNIT III Centroid, Centre of Gravity & Moment of Inertia**

**Centroid and Centre of Gravity:** Centroid of a plane curve, Centroid of a simple plane area from first principle, centroid of composite section, Pappu's theorems, Centre of Gravity and its implications.

**Moment of Inertia:** Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Radius of gyration, Moment of inertia of composite sections; Mass moment inertia of simple solids, Mass moment inertia of composite solids

**IV Introduction to Kinematics & Kinetics**

**Introduction to Kinematics:** Rectilinear motion, curvilinear motion, Inclined projection, Rotation about fixed axis, Kinematics of plane motion.

**Introduction to Kinetics of Rigid Bodies:** Basic terms, general principles in dynamics, D'Alembert's principle, kinetics of general plane motion, connected bodies, Kinetics of rigid body rotation.

**UNIT V Energy, Momentum Methods & Virtual Work:**

**Work Energy Method**: Work energy principle for translation and its application in plane motion of connected bodies, Work done by a spring, Work energy principle for fixed axis rotation, Work energy method applied to plane motion.

**Virtual Work & Momentum Methods**: Introductory concepts of Virtual Work, Principle and application of Virtual work. Linear Impulse and momentum, Conservation of momentum, Impact of elastic bodies, Coefficient of restitution.

**TEXT BOOKS:**


1. S. Timoshenko, D.H. Young, J.V.Rao, Sukumar Pati, Engineering Mechanics, TATA McGraw Hill Education, 2017 .
2. Ferdinand. L. Singer, Engineering Mechanics: Statics & Dynamics, BS Publications, 2011 .

**REFERENCE BOOKS:**


1. R.C.Hibbeler, Engineering Mechanics - Statics & Dynamics, Pearson, 2016.
2. J.L. Meriam, L.G. Kraige, J.N.Bolton, Engineering Mechanics: Dynamics, Wiley India Edition, 2018.
3. Ferdinand P. Beer, E. Russell Johnston, Vector Mechanics for Engineers, McGraw Hill Publ, 2019.


**COURSE OUTCOMES**

At the end of the course the student will be able to

i. Draw free body diagrams for different components of structural/machine members.
ii. Apply the equations of equilibrium for solving the problems of statics.
iii. Determine moment of inertia of any Area/Volume with definable boundaries about any axis.
iv. Differentiate centroid, centre of mass and centre of gravity
v. Find the displacement, velocity and accelerations of bodies subjected to unbalanced system of forces.
vi. Compare different methods of approach for solving the problems of dynamics
vii. Will be able to apply the knowledge of engineering mechanics for solving the problems of statics and dynamics

| **A2MET301 ENGINEERING MECHANICS** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | | | Department of Mechanical Engineering | | | | | | | | | | | |
| CO / PO/ PSO mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| i | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 2 | 2 |
| ii | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 2 | 2 |
| iii | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 1 | 1 |
| iv | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 1 | 1 |
| v | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 2 | 2 |
| vi | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 1 | 1 |
| vii | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 3 | 3 |

| **A2MET301 ENGINEERING MECHANICS** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2MET302 | SEMESTER - III | L | T | P | C |
|---|---|---|---|---|---|
| | ENGINEERING THERMODYNAMICS | 3 | 0 | 0 | 3 |
| | Total number of hours (48 lecture hours ) | | | | |

**SYLLABUS**

**UNIT I**

**Work and Heat transfer**: Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work. (4)

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy. (4)

**UNIT II**

**Properties of Pure substances:** Definition of Pure substance, Ideal Gases and real gases, gas mixtures, Compressibility charts- Properties of two-phase systems - Const. temperature and Const. pressure heating of water.

Definitions of saturated states; P-v-T surface; Use of steam tables, Saturation tables; superheated tables; Identification of states & determination of properties, Mollier's chart. (8)

**UNIT III**

**First Law of Thermodynamics:** First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; applications of steady flow energy equation.(6)

**Second Law of Thermodynamics:** Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle, Carnot theorem, corollary of Carnot theorem, Absolute temperature scale. (10)

**UNIT IV**

**Entropy:** Clausius inequality; Definition of entropy S; Demonstration that entropy S is a property; Evaluation of 'S' for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Principle of increase of entropy; Illustration of processes in T-s coordinates, entropy balance to various systems. (8)

**UNIT V**

**Exergy:** Availability and Irreversibility, Availability function for systems and Control volumes undergoing different processes, Lost work. second-law efficiency. Exergy balance to closed systems and control volumes. (8)

**COURSE OUTCOMES:**

After completing this course, the students will be able to

i. Define system, heat, work and pure substance with suitable examples
ii. Calculate the heat transfer, work done for different thermodynamic process and Evaluate the thermodynamic properties of steam and gas mixtures
iii. State first law and second law of thermodynamics
iv. Apply first and second law of thermodynamics to thermal systems
v. Define and demonstrate the concept of entropy and evaluation of s for different fluids
vi. Describe the concept of exergy and apply exergy balance for closed and steady flow systems
vii. Apply laws of thermodynamics for open and closed systems and calculate properties of pure substances and gas mixtures

**TEXT BOOKS:**


1. Yunus A. Cengel , Michael A. Boles, *Thermodynamics: An Engineering Approach*, McGraw Hill.2017
2. P.K.Nag, *Engineering Thermodynamics*, McGraw Hill Education. 2017.


**REFERENCE BOOKS:**


1. Moran, M. J. and Shapiro, H. N., *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.2014.
2. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., *Fundamentals of Thermodynamics*, John Wiley and Sons. 2012.


| **A2MET302: ENGINEERING THERMODYNAMICS** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO 1 | PSO 2 |
| i. | 3 | 3 | | | | | | | 1 | 1 | | | | |
| ii. | 3 | 3 | | 2 | 2 | | | | 1 | 1 | | | | |
| iii. | 3 | 3 | | 2 | | | | | 1 | 1 | | | 1 | |
| iv. | 3 | 3 | | 2 | | | | | 1 | 1 | | | 1 | |
| v. | 3 | 3 | 1 | 1 | | | | | 1 | 1 | | 1 | | |
| vi. | 3 | 2 | | | | | | | | | | | | |
| vii. | 3 | 2 | | | 1 | | | | | | | | 2 | |

| **A2MET302 : ENGINEERING THERMODYNAMICS** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2MET303 | SEMESTER - III | L | T | P | C |
|---|---|---|---|---|---|
| | MATERIALS ENGINEERING | 3 | - | - | 3 |
| | Total Contact Hours – 48 | | | | |

## SYLLABUS

**UNIT-I**

**Crystallization:** Importance of Material Engineering study, Crystallization &Critical radius. Grain Size Measurement, Grain morphology in casting and welding, Imperfection in solids, Plastic deformation.

**UNIT-II**

**Alloying and Phase diagrams:** Need of alloys, Solid solution, Gibb's phase rule, Phase diagrams: Concept of Tie line and Lever rule, Classification of Binary Phase diagrams, Isomorphous Phase diagram, Eutectic Phase diagram, Peritectic, Eutectoid, Strengthening mechanism and Polymorphism, Fe-$Fe_3C$ Phase diagram, Problems on Iron-iron carbide phase diagram.

**UNIT-III**

**Ferrous, Non Ferrous Metals and Alloys:** Steels and its classification, Steel Designating system, Role of alloying elements in steel, Stainless steel, Tool steel, Hadfield steel, dual phase steel, Maraging steel, Cast iron and its classification, Grey CI, White CI, Malleable and spheroidal CI. Aluminum and its alloys, Copper and its alloys, Titanium and its alloys, Nickel based super alloys

**Advanced Materials:** Composite materials and their classification with applications, Ceramic materials and classification with applications, Materials for Marine applications, Materials for Aerospace applications, Nano Materials and classification, Bio materials, Concept of DBT & UF grains.

**UNIT-4**

**Bulk Heat treatment:** Need for Heat treatment Stages of Heat treatment, Classification, Annealing and types, Normalizing, Construction of TTT, CCT diagram and applications,

Martempring, Austempering, Hardening, Hardenability, Jominy End Quench Test, Tempering, Age hardening, Cryogenic Heat treatment

**UNIT-5**

**Surface Heat treatment**: Surface hardening Techniques: Carburizing, Nitriding, Carbo- Nitriding, Cyaniding, Flame hardening, Induction hardening, Plasma hardening, Vacuum Hardening; Surface treatment techniques: Galvanizing, Boronizing, Physical Vapor Deposition, Chemical Vapor Deposition.

**TEXT BOOKS:**

1. W. D. Callister, Materials Science and Engineering-An Introduction", 6th Edition, Wiley India. 2006
2. Sidney H. Avner: Introduction to Physical Metallurgy, TMH Publishing Co. Ltd. New Delhi,1997.

**References:**

1. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
2. V.D.Kodgire, Sushil V. Material Science and Metallurgy,43rd Edition, Everest Publishing house,2018.

**COURSE OUTCOMES:**

Student will be able to

ii. Describe crystallization and grain development.
iii. Describe phase diagram and its implications for different alloy systems.
iv. Select suitable material for an intended application.
v. Classify recently developed materials and describe their applicability in wide areas
vi. Select suitable heat treatment process for required mechanical properties of metals
vii. Select suitable surface treatment process for specific applications
viii. Select suitable material and treatment approach for required structure-property correlation

| **A2MET303- MATERIALS ENGINEERING** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 |
| i. | 2 | 3 | - | - | - | - | - | - | 2 | 1 | - | 1 | - | - |
| ii. | 2 | 2 | - | - | - | - | - | - | 2 | 1 | - | 1 | - | - |
| iii. | 2 | 3 | 1 | 1 | - | - | - | - | 2 | 1 | - | 1 | - | - |
| iv. | 1 | 1 | 1 | 1 | - | - | - | - | 2 | 1 | - | 1 | - | - |
| v. | 3 | 2 | 1 | 1 | - | - | - | - | 2 | 1 | - | 1 | - | - |
| vi. | 3 | 2 | 1 | 1 | - | - | - | - | 2 | 1 | - | 1 | - | - |
| vii. | 2 | 2 | 1 | 1 | - | 1 | - | - | 2 | 1 | - | 1 | - | - |

| **A2MET303 MATERIALS ENGINEERING** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2MEL301 | SEMESTER - III | L | T | P | C |
|---|---|---|---|---|---|
| | Computer Aided Geometric Design and Assembly | - | - | 4 | 2 |
| | Total Contact Hours – 64 | | | | |

## SYLLABUS

**Introduction to Modeling packages - ProEngineer, Ideas, CATIA, Uni Graphics, Solid Works.**

**Drafting**

1. Simple 2D-drawing using sketcher options
2. Complex and Application Oriented 2D-drawing using sketcher options

**Modeling**

3. Simple 3D- drawing using form features
4. Complex 3D-drawing using form features

**Assembly**

5. Universal Coupling
6. Oldham Coupling
7. Knuckle Joint
8. Cotter joint
9. Eccentric
10. Single plate clutch
11. Square Tool post
12. Clapper block

**REFERENCE BOOKS:**


1. CATIA V5R14 for Designers by Sham Tickoo
2. Creo Parametric 2.0 by Louis Gary Lamit


**COURSE OUTCOMES:** At the end of the course the student will be able to

i. Present an overview of CAD and describe its applications in different fields

ii. Describe common terms associated with CAD hardware and software.

iii. Give outline of basic principles associated with CAD and to demonstrate common drafting and modeling techniques used by professionals.

iv. Introduce the advanced capabilities of CAD and how they can be used to increase productivity

**CO/PO Mapping**

| A2MEL301: Computer Aided Geometric Design and Assembly | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PS02 |
| i. | 1 | | 3 | | 3 | | | | 1 | 2 | | 2 | 3 | |
| ii. | 1 | | 3 | | 3 | | | | 1 | 2 | | 2 | 3 | |
| iii. | 1 | | 3 | | 3 | | | | 1 | 2 | 1 | 3 | 3 | |
| iv. | 1 | | 3 | | 3 | | | | 1 | 2 | 1 | 3 | 3 | |

| A2MEL301: Computer Aided Geometric Design and Assembly | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2CHA701 | SEMESTER – III | L | T | P | C |
|---|---|---|---|---|---|
| | ENVIRONMENTAL SCIENCE | 2 | 0 | 0 | 0 |
| | Total Contact Hours – 30 | | | | |

| COURSE OBJECTIVES | |
|---|---|
| 1. | To study about the scope and importance of multidisciplinary nature of environmental science. |
| 2. | To study about the natural resources and their importance for the sustenance of life and the need to conserve natural resources. |
| 3. | To study about the ecosystem and its function in the environment. |
| 4. | To study about the importance of biodiversity, the threats to biodiversity and conservation practices to protect the biodiversity. |
| 5. | To study about the various types of pollution, its impact and measures to control pollution. |
| 6. | To study about solid waste management techniques |
| 7. | To study about the sustainability nature of environment |

## ENVIRONMENTAL SCIENCE

**SYLLABUS:**

**UNIT – I:**

**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance of Multidisciplinary nature of Environmental Studies, Climate change: Global warming, Acid rains, Ozone layer depletion

**UNIT – II:**

**Natural resources:**

Forest resources, deforestation, case studies –Water resources – Use and over utilization of surface and ground water –Floods, drought, conflicts over water, dams – benefits and problems, Mineral resources: Use and exploitation, environmental effects of mining, case studies. Food resources- World food problems, effects of modern agriculture, Land resources-land degradation, soil erosion and desertification, Energy resources: Growing energy needs, renewable and non-renewable energy sources.

**UNIT – III:**

**Part A:**

**Ecosystem:** Concept of an ecosystem**,** Classification, Structure of an Ecosystem: Producers, consumers and decomposers, different functions of an ecosystem.

**Part B:**

**Biodiversity**

Definition and types: genetic, species and ecosystem diversity, Values of biodiversity, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT – IV:**

**Environnemental Pollution :**

Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution.

**UNIT – V: Social issues and the environment:**

Sustainability, urban and energy related problems

Solid waste Management: Causes, effects and control measures of urban and industrial wastes,

**Text Books:**

1. Environmental Studies by Anubha Kaushik, 4th Edition
2. A Textbook of Environmental Studies by Shaashi Chawla, TMH, New Delhi
3. Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

**References:**

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada
3. Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi

**Course Outcomes:**

Students will be able to:

1. Understand the scope and importance of multidisciplinary nature of environmental science.
2. Understand the natural resources and their importance for the sustenance of life and the need to conserve natural resources.
3. Understand ecosystem and its function in the environment,
4. Understand the importance of biodiversity, the threats to biodiversity and conservation practices to protect the biodiversity.
5. Understand the various types of pollution, its impact and measures to control pollution.
6. Understand solid waste management technologies.
7. Understand the sustainability nature of environment.

| **ENVIRONMENTAL SCIENCE** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 |
| CO-1 | 2 | | | | | 1 | | | | | | | | |
| CO-2 | 1 | | | | | 2 | 2 | | | | | | | |
| CO-3 | 2 | | | | | 2 | 1 | | | | | | 1 | |
| CO-4 | 1 | | | | | 1 | | | | | | | | |
| CO-5 | 1 | 1 | | | | | 1 | | | | | | 1 | |
| CO-6 | 1 | | | | | 2 | 1 | | | | | | 1 | |
| CO-7 | 1 | 1 | | | | | | | | | | | 1 | |

| **A2CHA701** | **ENVIRONMENTAL SCIENCE** |
|---|---|
| Course designed by | Department of Chemical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29th Jun, 2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13th AUG, 2020 |

| A2MAT110 | SEMESTER - IV | L | T | P | C |
|---|---|---|---|---|---|
| | MATHEMATICS-IV (common to CIV, MEC & CHE) | 3 | 0 | - | 3 |
| | Total Contact Hours – 48 | | | | |

## Syllabus

**Unit-I: Fourier Series** **09 Hours**

Outlines: Periodic function, even and odd functions, generalized rule of integration by parts, special wave forms like square wave, half wave rectifier, full wave rectifier, saw-toothed wave, triangular wave; Fourier Series expansions: Euler's formulae for Fourier series, Dirichlet's conditions, Fourier series expansions for functions of period $2\pi$, functions having points of discontinuity, Change of interval, Fourier series expansions for functions of period 2L, Fourier series of odd and even functions; Half range Fourier Series: Half range sine and cosine series.

**Unit-II: Fourier Transformations** **08 Hours**

Fourier Integral: Fourier integral theorem and its complex, sine and cosine forms (statements only); Fourier Transformations (FTs): Concepts of integral transforms and its Kernels, Complex Fourier transformation, Fourier sine transformation & Fourier cosine transformations and their inverse transforms, Properties of Fourier transforms, Computation of Fourier, Fourier sine and Fourier cosine transformations using properties, evaluation of integrals, deductions of identities, Applications of FTs to solve integral equations.

**Unit-III: Applications of PDEs** **07 + 07 Hours**

Transverse vibrations of a stretched string (One dimensional wave equation): Solution by separation of variables method, boundary conditions, formation of physical problems of stretched string in to a boundary value problem (BVP), Solving BVPs for their particular solutions;

One dimensional heat flow equation: Solution by separation of variables method, modeling one dimensional heat flow phenomena as a BVP, solving BVPs for their particular solutions; Two dimensional heat flow equation (Laplace equation): Solution by separation of variables method, modeling two dimensional heat flow phenomena as a BVP, solving BVPs for their particular solutions.

**Unit-IV: Complex Variables (Differentiation)** **09 Hours**

Functions of complex variables: Neighborhood of a point in complex plane, Regions, limit and continuity of a complex function, derivative of a complex function, Cauchy-Riemann equations, analytic function, Entire function, Conjugate function, C-R equations in polar coordinates, Laplace equation, harmonic functions, harmonic conjugates; Construction of analytic functions: Milne-Thomson method; Applications to Electrical field and fluid flow problems: Complex potential, velocity potential, stream function in electrical field and fluid flow problems.

**Unit-V: Complex Variables (Integration)** **08 Hours**

Line integral of a complex function: Concept of complex integration, simple closed curve and multiple curves, simply and multiply connected domains, line integral and its properties, evaluation of line integral, Cauchy's integral formula, Cauchy's integral theorem, Cauchy's integral formula for derivatives; Outlines: of Taylor's & Laurent's series; Cauchy's residue theorem: Concepts of zeros, singularities and poles of an analytic function, residues, calculation of residues, Cauchy's residue theorem.

//Topics prefixed with 'Outlines' are not for assessment//

**Text Books**:

TB1 B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017

TB2 T.K.V. Iyengar et al, Mathematical Methods, S.Chand Publishers

**Reference Books:**

RB1 Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011

RB2 B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

RB3 T. Veerarajan, Higher Engineering Mathematics, Tata McGraw-Hill, 2008

**Course Outcomes (COs):** At the end of course, students shall be able to:

| | | |
|---|---|---|
| CO 1 | KO#1 | Recall the concepts of Fourier Series and Fourier Transformations |
| CO 2 | KO#2 | Recall the Applications of PDEs |
| CO 3 | KO#3 | Recall the concepts of Complex variables |
| CO 4 | UO#1 | Use and Interpret the concepts of Fourier Series and Fourier Transformations |
| CO 5 | UO#2 | Use and interpret the Applications of PDEs |
| CO 6 | UO#3 | Use and interpret the concepts of Complex variables |
| CO 7 | AO#1 | Apply the concepts of Fourier Series, Fourier Transformations, PDEs and complex variables to model and solve real world problems. |

**CO/PO Mapping**

| Course Title: | Mathematics-IV (Common to MECH, CHEM & CIVIL) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code: | A2MAT110 | | | | | | | | | | | | | |
| Course Designed by | Dept. of Mathematics | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO2 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO3 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO4 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO5 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO6 | 3 | 3 | | 2 | | | | | | | 2 | | | |
| CO7 | 3 | 3 | | 2 | | | | | | | 2 | | | |

| | |
|---|---|
| Course designed by | DEPARTMENT OF MATHEMATICS |
| Approval | Approved by: Meeting of Board of Studies held on 06.07.2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| | | | | | |
|---|---|---|---|---|---|
| **A2MET202** | **SEMESTER - IV** | **L** | **T** | **P** | **C** |
| | **Design Thinking and Product Innovation** | 3 | - | - | 3 |
| | **Total Contact Hours – 64** | | | | |

**SYLLABUS:**

**UNIT 1: Introduction to Design Thinking**

**Design Thinking in General :** The Concept of Design Thinking, Wicked Problems, The Principles and the mindset of Design Thinking, Generic Phases of Design Thinking process and activities involved in each of the phase, Design Thinking Frameworks.

**Design Thinking for New Product Development :** Role of Design Thinking in NPD, When to Apply Design Thinking and When Not to, StageGate Vs Lean Vs. Agile methodologies Vs Design Thinking, Design innovation.

**UNIT 2: Problem Identification process in Design Thinking**

**Empathize:** Empathize - Goals and methods, Usage of Tools (Design Briefs - Nine Criteria with example), Usage of Tools (Creation of Personas, Illustrative application of Personas), Student Activity on Empathize phase.

**Define:** Importance of Define Phase, activities, Usage of Tools (Experience Mapping process with example), Usage of Tools (Developing Insights using HMW Questions, question ladder), Student Activity on Define phase.

**UNIT 3: Problem Solving Process in Design Thinking, Case Study discussion & implementation**

**Ideate:** Importance of Ideate Phase, 77 Design Heurisitics, Diverge Ideas, Converge Ideas Student Activity on Ideate phase

**Prototype & Test*:*** "A Design Thinking Product Development Framework", What Is a Story? What Is a Prototype?, "Putting It Together—Combining Stories and Prototypes", Employing Stories and Prototypes in Your Process

**Case Study Implementation:** Case Study Discussion mapping the End to End Design Thinking Process to the topics discussed till cluster 3**,** Case Study - 1 (Problem Identification Processes in Design Thinking)

Case Study - 1 (Problem Solving Processes in Design Thinking)

Case Study - 2 (Problem Identification Processes in Design Thinking)

Case Study - 2 (Problem Solving Processes in Design Thinking)

**Student implementing phases of DT towards Problem Solving:**

Problem Area Identification

Application of Empathize Phase

Application of Empathize Phase

Case Study Evaluation Phase - 1

**UNIT 4: Product Innovation**

**The Role of Design in Early-Stage Ventures:** Introduction: An Emerging Start-up Culture, The Process: Winding from idea to product, Discussion on Case Study, Troubleshooting Common Mistakes

**Optimal Design for Radically New Products:** Introduction- six ideas and their implementation

Communicate the Challenge Goal toward Radically New Products, Shift Time Frames to Future and Past, Promote an Emerging Technology Focus across the Consumption Chain, Use of Analogical Thinking, Look for Novel Ways to Solve Simple Problems, Leverage More Ideators via Crowdsourcing

**UNIT 5: Case Study implementation**

**Student implementing phases of DT towards Problem Identification & Solving**

Application of Define Phase

Application of Define Phase

Case Study Evaluation Phase - 2

Application of Ideate Phase

**Student implementing phases of DT towards Problem Identification & Solving**

Application of Ideate Phase

Build Prototype

Test the solution

Case Study Evaluation Phase – 3

**Text books & Reference books:**


1. Design think new product development essentials from the PDMA – Wiley edition
2. Product Design and Development Karl Ulrich (Author), Steven Eppinger –Fifth edition
3. Design Thinking Getting Started Sidneyeve Matrix, https://innovationbydesign.pressbooks.com/
4. https://en.wikipedia.org/wiki/Wicked_problem
5. https://web.mit.edu/jrankin/www/engin_as_lib_art/Design_thinking.pdf
6. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
7. https://www.interaction-design.org/literature/article/design-thinking-a-quick-overview
8. https://www.designorate.com/measuring-the-impact-of-design-thinking/
9. https://www.mindtheproduct.com/understanding-design-thinking-lean-agile-work-together/
10. https://www.sopheon.com/spiral-development-lean-vs-stage-gate/#:~:text=In%20practice%2C%20lean%20product%20development,is%20completed%20within%20each%20stage.

11. https://medium.com/codomo/what-is-design-innovation-why-you-need-to-know-it-b8d850503b3a
12. https://dschool-old.stanford.edu/groups/k12/wiki/3d994/empathy_map.html
13. https://www.designkit.org/methods/how-might-we
14. https://careerfoundry.com/en/blog/ux-design/what-is-ideation-in-design-thinking/
15. https://www.interaction-design.org/literature/article/stage-3-in-the-design-thinking-process-ideate

**Course Outcomes:**

On completion of the course, students will have the ability to:

i. Describe various phases of Design Thinking and various tools for Empathizing in Design Thinking
ii. Describe various tools for Ideation, Prototyping in Design Thinking
iii. Outline the Design process for new Product development in startups and techniques to design Radically New Products
iv. Give examples for empathize and define phases in Design Thinking
v. Give examples for Ideation, Prototyping in Design Thinking
vi. Draw inferences on designing Radically New Products in emerging startups.
vii. Apply Design Thinking principles, methodologies, phases and tools to design a New/Radically new Process/Service/Product

**CO/PO Mapping**

| A2MET202: Design thinking and Product Innovation | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PS02 |
| viii. | 3 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 2 | 2 |
| ix. | 3 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 2 | 2 |
| x. | 3 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 2 | 2 |
| xi. | 3 | 3 | 3 | 2 | 2 | 1 | | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| xii. | 3 | 3 | 3 | 2 | 2 | 1 | | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| xiii. | 3 | 3 | 3 | 2 | 2 | 1 | | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| xiv. | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 3 | 3 |

| A2MET202: Design Thinking and Product Innovation | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2MET304 | SEMESTER - IV | L | T | P | C |
|---|---|---|---|---|---|
| | STRENGTH OF MATERIALS | 3 | - | - | 3 |
| | **Total Contact Hours – 48** | | | | |

## SYLLABUS

**UNIT I**

**Simple Stress and Strains:** Concept of stress and strain: Types of stresses and strains-Hooke's law-Poisson's ratio-Factor of safety**,** Mechanical properties of materials**,** Stress-strain diagram for ductile and brittle materials**,** Analysis of bar of varying sections: Uniform-Stepped and tapered sections**,** Principle of super position. **(4)**

**Composite bars and temperature stresses:**

Elongation of a bar due to self-weight- bar of uniform strength**,** Composite bars**,** Stresses in bolts and nuts**,** Temperature stresses in composite bars**,** Strain energy under different loadings. **(5)**

**UNIT II**

**Volumetric strain and Elastic constant**s**:** Volumetric strain of a cylindrical rod**,** Rectangular bar subjected to an axial tensile load in the direction of its length**,** Rectangular bar subjected to three mutually perpendicular forces**,** Relation between Young's modulus and Rigidity modulus**,** Relation between Young's modulus and Bulk modulus. **(4)**

**Principal stresses:** Principal planes and principal stresses-Analytical method for determining stresses on oblique section-Member is subjected to like direct stress in two mutually perpendicular directions**,** Analytical method - Member is subjected to direct stresses in two mutually perpendicular directions accompanied by a simple shear stress**,** MOHR'S circle – A body subjected to two mutually perpendicular principal tensile stresses of unequal intensities**,** Unequal and unlike**,** accompanied by shear stress. **(5)**

**UNIT III**

**Torsion of Circular Shafts :** Torsion equation with assumptions**,** Polar modulus- Strength of a shaft and torsional rigidity / stiffness**,** Torque and power transmitted by solid circular shafts**,** Hollow circular shafts. **(5)**

**Thin and thick cylinders:** Thin cylinders - Stresses in thin cylinders-hoop stress**,** longitudinal stress**,** Change in dimensions**,** Efficiency of a joint**,** Thick cylinders-Lame's equation- assumptions**,** Thick cylinder subjected to inside fluid pressures. **(4)**

**Shear Force & Bending Moment Diagrams in Beams**: Beam – classification – loads and reactions – concept of SF and BM – Sign convention - Cantilever beam subjected to point loads**,** Distributed loads**,** Uniformly varying loads**,** Combined loads**,** Simply supported beams subjected to point loads**,** Distributed loads**,** Uniformly varying loads**,** Combined loads**,** Over hanging beams subjected to point load and distributed loads**,** Beams subjected to couples. **(9)**

**UNIT IV**

**Bending stresses in Beams:** Bending stresses in beams - pure or simple bending-terminology-assumptions**,** Bending equation-moment of resistance**,** Bending stress in symmetrical sections**,** Unsymmetrical sections**,** Strength of a section. **(5)**

**Shear stresses in Beams:** Shear stress in a beam-derivation**,** Shear stress distribution in the beams of rectangular section**,** Circular section**,** I-Section**,** T-Section. **(4)**

**UNIT V**

**Deflection of Beams**: Deflection of beams-Relation between slope-deflection and radius of curvature**,** Double integration method-Cantilever beam subjected to point load at is free end**,** point load at a distance from fixed end**,** uniformly distributed load**,** Uniformly varying load**,** Simply supported beams subjected to point loads at its centre**,** Eccentric point load**,** Distributed and varying loads**,** Beams subjected to couples**,** Macaulay's method. **(9)**

**TEXT BOOKS:**


1. Popov E.P, "Engineering Mechanics of Solids", PHI, New Delhi, 2010.
2. R K Bansal, Strength of materials -5th Edition-Laxmi publications-2013


**REFERENCE BOOKS:**


1. Ferdinand Beer & Russell Johnston, Mechanics of materials, TATA McGraw Hill-2005
2. S.S. Rattan, Strength of Materials, Tata McGraw Hill, 2009
3. S.S.Bhavikatti, Strength of Materials, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.


**COURSE OUTCOMES**

Student will be able to

i) know the various mechanical properties of materials, stresses and strains, Factor of safety, elastic constants and their relationship.
ii) draw the shear force and bending moment diagrams for beams subjected different type of loadings and know about various stresses induced in shafts and pressure vessels.
iii) know about flexural and shear strength in beams along with deflections.
iv) understand the concept of Mohr's circle and determine principal stresses.
v) understand the stress distribution in beams, pressure vessels and shafts.
vi) calculate the bending, shear stresses and deflections at any location along the beams.
vii) analyze various members subjected to tension, compression, torsion, bending and shear stresses, deflections using the fundamental concepts of stress, strain and elastic behavior of materials.

| A2MET304 STRENGTH OF MATERIALS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | | | Department of Mechanical Engineering | | | | | | | | | | | |
| CO / PO/ PSO mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| viii | 3 | 3 | 3 | 2 | 1 | 1 | 1 | | | | | 1 | 1 | 2 |
| ix | 3 | 3 | 3 | 2 | 1 | 1 | 1 | | | | | 1 | 1 | 2 |
| x | 3 | 3 | 3 | 3 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| xi | 3 | 3 | 3 | 2 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| xii | 3 | 3 | 3 | 3 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| xiii | 3 | 3 | 3 | 3 | 1 | 1 | 1 | | | | | 1 | 1 | 2 |
| xiv | 3 | 3 | 3 | 3 | 1 | 1 | 1 | | | | | 1 | 1 | 2 |

| A2MET304 STRENGTH OF MATERIALS | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2MET305 | SEMESTER - IV | L | T | P | C |
|---|---|---|---|---|---|
| | Fluid Mechanics and Fluid Machines | 3 | 0 | 0 | 3 |
| | Total number of hours : 48 lecture hours | | | | |

**UNIT I**

**Fluid properties, Pressure measurement and Buoyancy:** Definition of fluid, properties of fluids- density, specific weight, specific volume, specific gravity, viscosity, Newton's law of viscosity, vapor pressure, compressibility, surface tension and capillarity, Newtonian and non-Newtonian fluids, pressure in a static fluid, pressure measurement, manometers-simple, U-tube differential manometer, buoyancy, stability of submerged and floating bodies. (9)

**UNIT II**

**Fluid kinematics, Dynamics and Dimensional analysis:** Types of flows, local acceleration and convective acceleration,-potential function, stream function, control volume-conservation of mass, conservation of momentum- pipe bend, Conservation of energy, Bernoulli's equation and its applications, need for dimensional analysis, methods of dimension analysis, similitude, types of similitude, dimensionless parameters, application and model analysis. (9)

**UNIT III**

**Viscous fluid flow:** Exact flow solutions of Navier-Stokes equations-Parallel flow in a straight channel, Couette flow, Hagen Poiseuille flow, Darcy Weisbach equation, friction factor, and Moody's diagram.

**Bounday layer theory and Flow through pipes**: Concept of boundary layer, laminar and turbulent boundary layer over a flat pate, establishment of flow in a pipe, boundary layer separation and control of separation,, flow through pipes, pipes in series, pipes in parallel, head loss in pipes and fittings. (10)

**UNIT IV**

**Hydraulic Turbines:** Classification of water turbines, heads and efficiencies, velocity triangles- Pelton wheel, Francis turbine and Kaplan turbines, draft tube, specific speed, unit quantities, performance curves for turbines, governing of turbines. (10)

**UNIT V**

**Hydraulic Pumps:** Rotodynamic pump, various heads and efficiencies, centrifugal pumps, working principle, velocity components at entry and exit of the rotor, work done by the impeller, specific speed of pump, NPSH, cavitation in pumps, performance curves, reciprocating pump working principle. (10)

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**TEXT BOOKS:**


1. S K Som, Gautam Biswas, Suman Chakraborthy, *Introduction to Fluid Mechanics and Fluid Machines*, McGraw Hill Education (India) Pvt Ltd., 2011.
2. Frank M. White, *Fluid Mechanics*, McGraw Hill Education (India) Pvt Ltd., 2017.

**REFERENCE BOOKS:**


1. K. Subramanya, *Fluid Mechanics and Hydraullic Machines*, McGraw Hill Education (India) Pvt Ltd., 2011.
2. Yunus A. Cengel, John M. Cimbala, *Fluid Mechanics- Fundamentals and Applications*, McGraw Hill Education, 2018.
3. P M Modi, S M Seth, *Hydraulics and Fluid Mechanics*, Standard Book House, 2017.


**COURSE OUTCOMES**

Student will be able to

i. Explain the effect of fluid properties on a flow system

ii. Apply fundamental laws of fluid mechanics for practical applications

iii. Prediction of flow phenomena of external and internal fluid flows

iv. Understand the concept of boundary layer theory

v. Analyze the performance of different hydraulic turbines.

vi. Estimate the performance parameters of rotodynamic and reciprocating pumps.

vii. Know, understand and apply the basic concepts of Fluid Mechanics to carry out professional engineering activities in the field of fluids.

**Mapping of Cos and POs**

| **A2MET305:Fluid Mechanics and Fluid Machines** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO/PO/PSO Mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 |
| i. | 3 | 2 | | | | | | | 3 | | | | 2 | 2 |
| ii. | 3 | 3 | 2 | 1 | | | | | 3 | | | | 2 | 2 |
| iii. | 3 | 3 | 1 | 1 | | | | | 3 | | | | 2 | 2 |
| iv. | 3 | 2 | | | | | | | 3 | | | | 2 | 2 |
| v. | 3 | 3 | 2 | 1 | | | | | 3 | | | | 1 | 2 |
| vi. | 3 | 3 | 2 | 1 | | | | | 3 | | | | 1 | 2 |
| vii. | 3 | 3 | 2 | 1 | | | | | 3 | | | | 1 | 2 |

| **A2MET305 Fluid Mechanics and Fluid Machines** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2MET306 | SEMESTER - IV | L | T | P | C |
|---|---|---|---|---|---|
| | MANUFACTURING PROCESSES | 3 | 0 | 0 | 3 |
| | Total Contact Hours – 48 | | | | |

**SYLLABUS**

**UNIT-I**

**Metal Casting**:

Classification of manufacturing processes. Casting- Definition, classification, Metals cast in the foundry-, factors that determine the selection of a casting alloy. **Patterns:** classification, materials, allowances and their importance. **Sand molding:** Sands, Binder, Additives; **Molding and Core making,** Jolt type, squeeze type and Sand slinger. Study on sand molding process Mould Making: Sand Properties and Testing, Core Making, **Melting technique**.

**UNIT-II**

**Concept of gating**: Functions and types. Design considerations in casting.

**Special Casting Techniques:** Shell molding, Investment molding, **Casting using metal molds:** Gravity die casting, pressure die casting, centrifugal casting, slush casting and continuous casting processes. **Fettling and cleaning of castings:** Basic steps involved. Sand Casting defects- causes, features and remedies.

**UNIT-III**

**Welding:** Classification- types of welds, welded joints, welding positions, and welded joints design. **Gas and arc welding processes:** Basic principle of Oxy acetylene welding, Shielded metal arc welding, submerged arc welding, TIG & MIG welding, Plasma arc welding

**Resistance welding:** Basic principle of Spot welding, Seam welding, Projection welding and Flash Butt welding. **Solid state welding**: Basic principle of Diffusion Bonding, Ultrasonic welding, Friction welding, and Friction stir welding. **High Energy Beam Welding:** Basic principle of LBW and EBW. Basic principle of Thermit Welding, Soldering and brazing. Gas cutting, plasma cutting. Welding defects.

**UNIT-IV**

**Sheet metal operation:** Blanking and piercing, deep drawing, stretch forming, bending, spring back, coining, Spinning. Types of presses, press tools and dies. Forces and power requirement in the above operations.

**Introduction to bulk forming:** Plastic deformation, fundamentals of hot and cold working.

**Forming processes:** Forging, Rolling, Extrusion and Drawing – advantages, limitations, applications and load estimation.

**UNIT-V**

**Processing of Plastics:** Types of Plastics, Properties, applications and their Processing methods & Equipment

**Additive Manufacturing:** Introduction to Rapid Manufacturing and Rapid Tooling, Prototyping Techniques: Stereo lithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modelling (FDM), Selective Laser Melting (SLM) and Laminated Object Manufacturing (LOM). Applications and limitations.

**TEXT BOOKS:**


1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2017.
2. Amit Bandyopadhyay and Susmita Bose, Additive manufacturing, CRC Press 2019.


**REFERENCE BOOKS:**


1. E P Degarmo, J T Black and A Kosher, Materials and Processes of Manufacture, John Wiley & Sons 2004.
2. G K Lal and S K Choudhury, Fundamentals of Manufacturing Processes, Narosa Publishing House 2005.
3. F Ostwald and J Munoz, Manufacturing Processes and Systems, John Wiley and Sons 2002.

**COURSE OUTCOMES:** The student will be able to

i. Describe processes involved in metal casting
ii. Design and select a suitable technique to get a sound cast
iii. Describe various metal joining techniques
iv. Select proper parameters and technique to get a sound weld
v. Describe various metal/plastic forming methods and rapid prototyping techniques
vi. Perform analysis of metal/plastic forming
vii. Suggest suitable manufacturing techniques for variety of product and materials

| **A2MET306 MANUFACTURING PROCESSES** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | | | Department of Mechanical Engineering | | | | | | | | | | | |
| CO / PO/ PSO mapping | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 |
| i | 2 | 1 | | | | 1 | | | | 1 | | | 1 | |
| ii | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 |
| iii | 2 | 1 | | | | 1 | | | | 2 | | | 1 | |
| iv | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 2 |
| v | 2 | 2 | | 1 | | 1 | | | | 2 | | | 1 | |
| vi | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| vii | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |

| **A2MET306 MANUFACTURING PROCESSES** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2MEI201 | SEMESTER - IV | L | T | P | C |
|---|---|---|---|---|---|
| | AI Tools and Techniques | 3 | - | 3 | 5 |
| | **Total Contact Hours – 96** | | | | |
| | **Prerequisites: PPS Course** | | | | |

**SYLLABUS:**

**UNIT-I: Introduction to Python**

The basic elements of python, Control Structures, Loops, Functions and scoping, Recursion, Global variables, Modules, Strings, Files.

**UNIT-II: OOP in Python**

Structured Types, Mutability and Higher-Order Functions, Tuples, Lists and Dictionaries, OOP in Python: Classes, Objects, Constructors, Inheritance, Encapsulation.

**UNIT-III: Introduction to AI**

Basics of AI. Applications of AI. Advanced search, Constraint satisfaction problems, Knowledge representation & reasoning, Non-standard logics, Uncertain and probabilistic reasoning

Conceptual introduction to **Machine Learning:** Introduction to Neural Networks, Supervised, Unsupervised, and Semi-Supervised Learning, introduction to Reinforcement learning, Deep Learning: layers, activation functions, optimizers.

**UNIT-IV: Image Processing**

Conceptual introduction to **Image Processing & Computer Vision:** Introduction to Image processing, Setting up OpenCV, Filtering Images, Tracking Faces with Haar Cascades, Detecting Edges and Applying Image Filters, Detecting and Tracking Different Body Parts, Extracting Features from an Image

**Applications: *GEN*:** Automation, Fault detection in machines, Crack detection.

**Unit V: Computer Vision:**

Image - Definition and Tagging. Classification of images. Tagging. Image formation, Deep Learning algorithms for Object detection & Recognition. Object Tracking, Stereo Vision and 3D Reconstruction, Augmented Reality

**Applications: *GEN*:** Robotics; Autonomous vehicles.

**Text Books:**


1. Ashok Namdev Kamthane, Amit Ashok Kamthane, Programming and Problem solving with PYTHON, McGraw Hill Education, 2018 (UNIT-I & II)
2. Joseph Howse, Prateek Joshi, Michael Beyeler, OpenCV Computer Vision Projects with Python, Packt Publishing (2016) – (UNIT-IV & V)
3. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach (UNIT-III)


**Reference Books:**


1. Tom Mickiewicz & Josh Zheng, Getting started with Artificial Intelligence, Published by O'Reilly Media, 2017.
2. Aurelian Geron, Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media, 2017.
3. Navin Kumar Manaswi, Deep Learning with Applications Using Python, Apress.

**Laboratory Experiments**

**Week 1)** Working of operators, expression evaluation, ways of accepting input and displaying output. Recall the basics of elements of Python and their usage in different advanced packages.

1. Write a program to calculate the area of a circle.
2. Write a program to calculate simple interest (SI). Read the principle, rate of interest and number of years from the user.
3. Write a program to read a temperature in Celsius from the user and convert it into Fahrenheit.
4. Write a program to calculate the distance between two points. The formula for computing distance is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1}$

**Week 2 & 3)** Explore on control and iterative statements.

1. Write a program to prompt a user to enter the values of the three different variables and display the output of the following expressions.
   a. p>q>r
   b. p<q<r
   c. p<q and q<z
   d. p<q or q<z
2. Write a program to prompt a user to enter two numbers. Find the greater number.
3. Write a program to test whether a number is divisible by 5 and 10 or by 5 or 10.
4. Write a program to prompt a user to enter a day of the week. If the entered day of the week is between 1 and 7 then display the respective name of the day.
5. Finding the Number of Days in a Month.
6. Write a program to check whether the number entered is an Armstrong number or not.
7. Write a program to print Fibonacci series up to 8.
8. Check if the number entered is prime or not.
9. Read the string “Hello World” from the user. Make use of continue keyword and remove space.

**Week 4 & 5)** Working on Functions, Strings, Files, and Global variables along with modules.

1. Write a program to add the sum of digits (using functions) from 1 to 25, 50 to 76 and 90 to 101 using three different for loops.
2. Write a program to find the factorial of a given number using functions.
3. Write a function calc_Distance(x1, y1, x2, y2) to calculate the distance between two points represented by Point1(x1, y1) and Point2 (x2, y2).
4. Write a recursive function which computes the nth Fibonacci number. Fibonacci numbers are defined as:
   Fib(0)= 1,
   Fib(1) = 1
   Fib(n)= Fib(n-1)+Fib(n-2). Write this as a Python code and then fi nd the 8th Fibonacci number.
5. Calculation of Compound Interest and yearly analysis of Interest and Principal amount.
6. Write a program to add the content of a file numbers.txt and display the sum of all the numbers present in the file.
7. Write a program to read the contents of a file Grades.txt and calculate the total marks and percentage obtained by a student.

**Week 6 &7)** Explore on python data Structures like lists, tuples and dictionaries.

1. Create a list of five elements. Pass the list to a function and compute the average of five numbers.
2. Write a program that prompts a user to enter the element of a list and add the element to a list. Write a function maximum(Lst) and minimum(Lst) to find the maximum and minimum number from the list.
3. Write a function print_reverse(Lst) to reverse the elements of a list.
4. Write a program to return prime numbers from a list.
5. Write a program to calculate the area of a rectangle by assigning the value to the attributes of a rectangle, i.e. length and breadth.
6. Write a program to count the frequency of characters using the get() method.

**Week 8)** Integrating Machine Learning with Computer Vision.

**Week 9)** Image preprocessing operations using openCV

**Week 10)** Feature extraction of an image

**Week 11)** Perform object detection.

**Week 12)** Object Tracking in a video

**Week 13)** Lab based Project

**Week 14)** Lab based Project

**Text books and References:**


1. Programming and Problem solving with PYTHON, McGraw Hill Education, Ashok Namdev Kamthane, Amit Ashok Kamthane, 2018.
2. AI Tool and Techniques Laboratory manual.
3. Computer Vision with Python 3, Packt Publishing Ltd, Saurabh Kapur, 2017.


**COURSE OUTCOMES:** At the end of the course the student will

i. Have the ability to describe basic programming constructs and object oriented programming concepts in Python
ii. Have the ability to describe the fundamentals of AI & ML concepts and DL concepts.
iii. Have the ability to describe about Image Processing & Computer Vision concepts
iv. Have the ability to explain the fundamental concepts and OOP of Python.
v. Have the ability to explain and outline the features of AI & ML and DL
vi. Have the ability to demonstrate the Image Processing techniques & Computer Vision concepts and apply in various domains.
vii. Have the ability to apply and bring to bear the full complement of concepts of Python to solve AI problems through programming with Python.

**CO/PO Mapping**

| A2MEI201 AI Tools and Techniques | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Electronics and Communication Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PS02 |
| i. | 3 | 3 | | | 3 | | | | | | 2 | 3 | | |
| ii. | 3 | 2 | 2 | 1 | | | | | | | | | 3 | |
| iii. | 3<br>2 | 2 | 2 | 1 | | | | | | | | | 1 | |
| iv. | 2 | 1 | | | 3 | | | | | | | 1 | | |
| v. | 3 | 2 | 2 | 1 | | | | | | | | | 2 | |
| vi. | 3 | 2 | 2 | 1 | | | | | | | | | 2 | |
| vii. | 3 | 2 | 2 | 1 | | | | | | | 1 | 2 | 3 | |

| A2MEI201 AI Tools and Techniques | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| A2MEL302 | SEMESTER - IV | L | T | P | C |
|---|---|---|---|---|---|
| | **Materials Lab** | 0 | 0 | 3 | 2 |
| | **Total number of hours (48 hours )** | | | | |

**LIST OF EXPERIMENTS**

**Strength of Materials**

1. Tensile Test - Uniaxial tension test on mild steel rod

   Scope: To prepare a standard tensile test specimen, conduct load extension test on UTM and find out various mechanical properties like Young's modulus, Percentage Elongation, Yield strength, Ultimate tensile strength and Breaking strength of various engineering materials.
2. Double shear test

   Scope: To Prepare a standard shear test specimen and conduct a shear test on UTM and find the ultimate shear strength of different materials.
3. Compression tests of non-metallic specimens

   Scope: To Prepare a standard Compression test specimen and conduct a compression test on CTM and find the ultimate compressive strength of different materials.
4. Torsion Test - Torsion test on mild steel rod

   Scope: To Prepare a standard torsion test specimen and conduct load deflection test and find properties like Rigidity modulus, ultimate shear strength, torsional rigidity etc.
5. Bending Test on metallic specimens.

   Scope: To prepare a standard bend test specimen and conduct load deflection test on UTM and find the flexural strength of materials
6. Impact test on a metallic specimen - Izod and Charpy Tests on M.S, C.I Specimen.

   Scope: To prepare a standard test specimen with notch and conduct impact test to find the impact strength of materials
7. Brinell, Rockwell and Vickers's Hardness test.

   Scope: To conduct hardness test and find hardness numbers of materials
8. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.

   Scope: To prepare a standard wear test specimen, conduct wear test on pin on disc wear testing machine and find wear resistance different of materials
9. Deflection Test - Bending deflection test on beams

   Scope: To determine young's modulus of brittle materials by conducting deflection test.
10. Microscopic examination of heat-treated and untreated metallic samples

**Metallurgy**

11. Material characterization of casting.
12. Identification of HAZ in weldments.
13. Material characterization of heat treated steels.
14. Microstructure of pure metal Copper/ Aluminium
15. Microstructure of Cast Iron.
16. Failure analysis of engineering component like refrigerator tubes/ connecting rod/ crankshaft.

Use material property charts for material selection.

**COURSE OUT COMES:**

On completion of the course, the students will be able to:

i. Understand and demonstrate the procedures of making a standard test specimen and conduct experimentation by setting up standard testing parameters to find various mechanical properties of Engineering Materials
ii. Correlate, comprehend and report on important mechanical properties of materials
iii. Understand the significance and application of various engineering materials
iv. A student can identify various phases of revealed microstructure.
v. Select suitable etchant as per the material for investigation.
vi. Understand different grades of steel and features related to hardenability curves.

| **A2MEL302: Materials Laboratory** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO 1 | PS02 |
| i. | 2 | 1 | | 3 | | | | | 3 | 2 | | | | 3 |
| ii. | 2 | 1 | | 3 | | | | | 3 | 2 | | | | 3 |
| iii. | 2 | 1 | | 3 | | | | | 3 | 2 | | | | 3 |
| iv. | 2 | 1 | | 3 | | | | | 3 | 2 | | | | 3 |
| v. | 2 | 1 | | 3 | | | | | 3 | 2 | | | | 3 |
| vi. | 2 | 1 | | 3 | | | | | 3 | 2 | | | | 3 |

| **A2MEL302 :Materials Laboratory** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

| | | | | | |
|---|---|---|---|---|---|
| **A2EHA702** | **SEMESTER – IV** | **L** | **T** | **P** | **C** |
| | **ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE** | **2** | **-** | **-** | **0** |
| | **Total Contact Hours – 30** | | | | |

**BROAD OBJECTIVE**

Make students understand the thought process, reasoning and holistic life style of Yogic system.

**Course Objectives:**

- To impart basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.

- To impart holistic lifestyle of Yogic-science and wisdom capsules in Sanskrit literature which is very important in modern society experiencing rapid technological advancements and societal disruptions.

- To focus on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

**Course Content**

- Basic Structure of Indian Knowledge System

  i) Ashtadasa vidya
  ii) Veda
  iii) Upavedha
  iv) Ayurvedha
  v) Dhanurvedha
  vi) Ghaandravedha
  vii) Vedang
    a. Shiksha,Kalp
    b. Nirutha
    c. Vyakaran
    d. Jyotishya)
  viii) Shastra
    a. Meemamsha
    b. Purana
    c. Tarka Shasthra

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

**Suggested Text/Reference Books**


1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritzof Capra, Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jha ( Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
7. GN Jha ( Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016
8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
9. P R Sharma ( English translation), Shodashang Hridayam


**COURSE OUTCOMES**

CO -1: The students will be able to comprehend the concepts of Indian Traditional Knowledge.

CO-2: The Students will be able to connect themselves with Knowledge from the modern scientific perspective.

CO-3: The students will be able to connect the past with the present advancements in Technology.

CO-4: The students will be to come to terms with the holistic health care system.

C0-5: The students will be able to develop critical thinking skills.

C0-6: The students will be able to comprehend the principles enshrined in ancient Sanskrit Literature

**CO/PO Mapping**

| **Course Title:** | | | | **ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | | | | | | **2** | | | | | | | | |
| **CO2** | | | | | | **2** | | | | | | | | |
| **CO3** | | | | | | **2** | | | | | | | | |
| **CO4** | | | | | | **2** | | | | | | | | |
| **CO5** | | | | | | **2** | | | | | | | | |
| **C06** | | | | | | **2** | | | | | | | | |

| | |
|---|---|
| Course designed by | DEPARTMENT OF ENGLISH & HUMANITIES |
| Approval | Approved by: Meeting of Board of Studies held on 23.06.2019 |
| | Ratified by: 5th Meeting of Academic Council, 13-07-2019. |

| A2MET201 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | **INTERNET OF THINGS (IoT)** | **3** | **0** | **0** | **3** |
| | **Total number of hours (48 lecture hours )** | | | | |

**SYLLABUS**

**UNIT I**

**Industry 4.0:** Globalization and Emerging Issues, The Fourth Revolution. (4)

LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories**.** (4)

**UNIT II**

**Introduction to IoT –** Definition and characterization of IoT, Physical and Logic Design of IoT, IoT Enabling Technologies, IoT Levels. (4)

Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style. (4)

**UNIT III**

**Design Principles of IoT-** Internet Principles – Internet communication, IP Addresses, MAC Address, TCP and UDP ports, Application Layer Protocols, Cyber securities. (8)

**Importance of Sensors in IoT**- Example Sensors, Interfacing with Arduino, Programming. (8)

**UNIT IV**

**Industrial IoT- Application Domain-1:** Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. (8)

**UNIT V**

**Industrial IoT- Application Domain-2**: Oil, Chemical and Pharmaceutical industry, Applications of UAVs in Industries, Case studies. Self-Referential Structures and Introduction to Lists; Advanced Topics in Industrial Applications. (8)

**TEXT BOOKS:**


1. Vijay Madisetti and ArshdeepBahga, *Internet of Things (A Hands-on-Approach), 1st Edition,* VPT, 2014.
2. Alasdair Gilchrist, *Industry 4.0: The Industrial Internet of Things*, APRESS, 2017.


**REFERENCE BOOKS:**


1. Yashavant Kanetkar, Shrirang Korde, *21 IoT Experiments*, BPB Publications, 2018.
2. Giacomo Veneri and Antonio Capasso, *Hands-On Industrial Internet of Things*, Packt Publishers, 2018.


**COURSE OUTCOMES:**

After completing this course, the students will be able to

i. Realize the industrial phase shift in the history of the mankind.
ii. Define the sub domains of IoT including the cloud storage models.
iii. Design the sensors required for an IoT based machine.
iv. Design the software protocols of using Phyton.
v. Design the mother board and processor required for an IoT based machine.
vi. Design an entire IoT based system for general purpose.
vii. Design an entire IIoT based system.

| A2MET201: INTERNET OF THINGS (IoT) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PS02 |
| i. | 3 | 3 | | | | | | | 1 | 1 | | | | |
| ii. | 3 | 3 | | 2 | 2 | | | | 1 | 1 | | | | |
| iii. | 3 | 3 | | 2 | | | | | 1 | 1 | | | 1 | |
| iv. | 3 | 3 | | 2 | | | | | 1 | 1 | | | 1 | |
| v. | 3 | 3 | 1 | 1 | | | | | 1 | 1 | | 1 | | |
| vi. | 3 | 2 | | | | | | | | | | | | |
| vii. | 3 | 2 | | | 1 | | | | | | | | 2 | |

| A2MET201: INTERNET OF THINGS (IoT) | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

Signature of the Academic Coordinator

Signature of the HOD

| A1MET307 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | THEORY OF MACHINES | 3 | - | - | 3 |
| | **Total Contact Hours – 48** | | | | |

**SYLLABUS**

**UNIT I**

**Mechanisms:** Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained ,degree of freedom of plane mechanism-Kinematic chain – inversion-inversions of quadric cycle chain – single and double slider crank chains.

**UNIT II**

**Velocity Analysis of plane mechanisms:**

**Kinematics:** Velocity– Motion of link in machine – Determination of Velocity diagrams – Graphical method – Application of relative velocity method for four bar chain, single slider crank mechanism. Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, determination of angular velocity of points and links of 4 bar and single slider crank mechanisms.

**Acceleration Analysis of plane mechanisms:** Determination of acceleration diagrams, Analysis of slider crank chain for displacement, velocity and acceleration of slider – Acceleration diagram for a given mechanism, Coriolis acceleration, determination of Coriolis component of acceleration.

**UNIT III**

Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – expressions for arc of contact and path of contact

**Gear Trains:** Introduction – Train value – Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains.

**Clutches: uniform pressure and wear theory,** Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

Brakes: Simple block brake, double block, band brake

**UNIT IV**

**Turning Moment Diagram and Fly Wheels:** Turning moment, connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Fly wheels.

**Governors:** Watt, Porter and Hartnell governors, Sensitiveness, isochronisms, hunting, effort and power of the governor.

**UNIT V**

**Balancing:** Balancing of rotating masses Single and multiple – single and different planes.

**Balancing of Reciprocating Masses:** Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – primary and secondary balancing of multi cylinder in line, radial engines.

**TEXT BOOKS:**


1. S.S.Rattan, Theory of machines, McGraw Hill companies, 5th edition, 2019.
2. Gordon R. Pennock, J.E.Shigley and John J. Uicker, Theory of machines and Mechanisms, Oxford University Press, 4th edition, 2014.

**REFERENCE BOOKS**


1. Thamos Beven, Theory of machines, Pearson Education India, 3rd edition, 2009.
2. Amitabha Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines, East West Publisher, 4th edition, 2008.


**COURSE OUTCOMES**

Upon completion of the course students will be able to

1. Differentiate different types of pairs and their usage in different types of mechanisms in achieving a desired motion and kinematic analysis of mechanisms.
2. List different types of gears, their terminology and clutches
3. Define importance of turning moment diagrams, flywheels, governors and balancing of machines
4. Draw inversions of simple mechanisms and velocity & acceleration diagrams of mechanisms
5. Differentiate various mechanical elements like gears, gear trains and clutches.
6. Evaluate the difference between various governors, static and dynamics balancing of rotating and reciprocating machines
7. Analyze various lower and higher pair mechanisms, clutches, flywheel, governors and machines

| **A1MET307 THEORY OF MACHINES** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | | | Department of Mechanical Engineering | | | | | | | | | | | |
| CO / PO/ PSO mapping | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 |
| i | 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| ii | 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| iii | 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| iv | 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| v | 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| vi | 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |
| vii | 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 1 |

| **A1MET307 THEORY OF MACHINES** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

Signature of the Academic Coordinator Signature of the HOD

| A2MET308 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | DESIGN OF MACHINE ELEMNTS | 3 | - | - | 3 |
| | **Total Contact Hours – 48** | | | | |

**SYLLABUS**

**UNIT-I**

**Introduction to Machine Design:** Introduction to the design process- types of design, Design procedure, Factor influencing design and manufacturing consideration, Design considerations - limits, fits, standardization, Preferred numbers, Factor of safety and Selection of FOS, Classification of Engineering Materials, Selection of Materials for Engineering Purposes.

**Torsional, Bending Stresses and combined stresses:** Torsional shear stress, Bending Stress in Straight Beams**,** Review of failure theories for static loading and combined loading. Eccentric loading: Direct and Bending load.

**UNIT – II**

**Design for Fatigue Strength**: Fatigue strength, types, fatigue and endurance limit, Stress concentration-theoretical stress concentration factors, Methods of reducing stress concentration, Notch sensitivity, Fatigue and Endurance limit, factors, S-N Diagram, Gerber, Goodman and Soderberg criteria for Design.

**Springs:** Types of springs, function, Material for Helical Springs, Standard Size of Spring Wire, Terms used in Compression Springs, Stresses and deflections of helical springs**,** Design of tension and compression springs**,** Springs for fatigue loading**,** Energy storage capacity of spring.

**UNIT – III**

**Keys and Couplings**: **Rigid and flexible couplings**: Function of key, types of keys, design of keys Definition, classification and selection of couplings, Flange coupling, Bushed pin type flexible coupling.

**Bearings**:

**Journal Bearings:** Classification, types of sliding contact bearings, hydrostatic and hydrodynamic journal bearings, Wedge Film Journal Bearings, Squeeze Film Journal Bearings, Properties of Sliding Contact Bearing Materials, Materials used for Sliding Contact Bearings, Design of journal bearing, Heat dissipation of bearings.

**Rolling Contact Bearings:** Advantages and Disadvantages of Rolling Contact Bearings Over Sliding Contact Bearings, Types of Rolling Contact Bearings, Designation of Ball bearings, Basic Static Load Rating of Rolling Contact Bearings,

**Static and Dynamic Equivalent Load for Rolling Contact Bearings:**

Static Equivalent Load for Rolling Contact Bearings, Life of a Bearing, Basic Dynamic Load Rating and Dynamic Equivalent Load for Rolling Contact Bearings, Dynamic Load Rating for Rolling Contact Bearings under Variable Loads, Reliability of a Bearing, Materials and Manufacture of Ball and Roller Bearings, Lubrication of Ball and Roller Bearings, analysis and design of rolling contact bearings.

**UNIT – IV**

**Design of Power Transmissions Elements:** Transmission of power by flat belt drives, length of open and cross belts**,** Centrifugal Tension, Maximum Tension in the Belt, Condition for Transmission of Maximum Power, initial tension**,** Transmission of power by V belt drives. Design of Knuckle joint.

**Transmission of Power by Spur Gears:**

**Spur Gears**: Definitions, stresses in gear tooth, causes of gear tooth failure, Lewis equation and form factor, Design for strength, Dynamic load and wear load, Design Procedure for Spur Gears.

**UNIT V**

**Design of Screw Joints**: Threaded fasteners, Stresses due to static loading, Bolts of Uniform Strength, stresses due to external loads, Stress due to Combined Forces, Design of joints under eccentric loading

**Welded Joints**: Types-Strength of butt welds, Types-Strength of fillet welds, eccentrically loaded welded joints.

**Riveted Joints:** Types, Strength of lap joints, Strength of butt joints, eccentrically loaded riveted joints.

**TEXT BOOKS:**

1. V B Bhandari, *Design of Machine Elements*, 4th edition, 2016,McGraw Hill Education (India) Pvt Ltd.
2. Dr.N. C. Pandya, Dr.C. S. Shah, *Machine Design* 20th Edition, 2015, Charotar Publishing House Pvt. Ltd.

**REFERENCE BOOKS:**

1. Shigley, J.E. and Mischke, C.R., *Mechanical Engineering Design*, 10th Edition, 2015, McGraw-Hill International.
2. R.L.Norton, *Mechanical Design – An Integrated Approach*, 4th edition, 2011, Prentice Hall Pearson.

**COURSE OUTCOMES**

Upon completion of this course student should be able to:

i. Determine the stresses in the members subjected to static and fatigue loads
ii. Find the stresses in the keys, couplings and bearings
iii. List different types of power transmission elements and different types of joints
iv. Design the members subjected to static and fatigue loads
v. Design the members like keys, couplings and bearings for different applications
vi. Design and select power transmission elements and types of joints for different applications
vii. Analyze various mechanical members subjected to both static and fatigue loads

| **A2MET308 DESIGN OF MACHINE ELEMNTS** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | | | Department of Mechanical Engineering | | | | | | | | | | | |
| CO / PO/ PSO mapping | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 |
| i | 3 | 3 | 2 | 3 | | 1 | 1 | | | | | 1 | 2 | 1 |
| ii | 3 | 3 | 2 | 3 | | 1 | 1 | | | | | 1 | 2 | 1 |
| iii | 3 | 3 | 2 | 3 | | 1 | 1 | | | | | 1 | 2 | 1 |
| iv | 3 | 3 | 2 | 3 | | 1 | 1 | | | | | 1 | 2 | 1 |
| v | 3 | 3 | 2 | 3 | | 1 | 1 | | | | | 1 | 2 | 1 |
| vi | 3 | 3 | 2 | 3 | | 1 | 1 | | | | | 1 | 2 | 1 |
| vii | 3 | 3 | 2 | 3 | | 1 | 1 | 1 | | | | 1 | 2 | 1 |

| A2MET308 DESIGN OF MACHINE ELEMENTS | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

Signature of the Academic Coordinator

Signature of the HOD

| A2MET309 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | INTERNAL COMBUSTION ENGINES | 3 | 0 | 0 | 3 |
| | **Total number of contact hours: 48** | | | | |

## SYLLABUS

**UNIT I**

**I.C. ENGINES:** Classification - Details of Main parts of Engine-nomenclature-Working principles of 2 Stroke & 4 Stroke SI and CI Engines, ideal cycles- Otto, Diesel, Dual, Brayton, Ericson Atkinson cycles, Valve timing and Port Timing Diagrams IC engine applications.

**UNIT II**

**Fuel-Air and Actual Cycles:** Details of Fuel-Air Cycles, Time Loss Factor, Heat Loss Factor, and Exhaust Blow down, Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction Comparison of Air Standard, Fuel –Air and Actual Cycles

**UNIT III**

**Combustion in S.I. Engines:** Stages of combustion – Importance of flame speed and effect of engine variables- Effect of spark timing on indicator diagram- Flame front propagation –Abnormal combustion–anti-knock additives- Methods to control knock– combustion chamber – requirements, types.

**Combustion in C.I. Engines:** Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Methods to control knock- Need for air movement, Swirl, squish and turbulence – open and divided combustion chambers– fuel requirements and fuel rating of SI and CI engine fuels.

**UNIT IV**

**Fuel supply systems in SI and CI engines:** carburetors, Port fuel injection, Direct injection and Common rail injection. Ignition system, Lubrication system and Cooling system**,** advanced IC Engine concepts (Super charger, Turbocharger and Electronic fuel injection).

**UNIT V**

**Testing and Performance:** Parameters of performance - Brake power – Determination of frictional power –Measurement of Indicated power- Measurement of air and fuel- Performance test –Methods to improve engine performance-Heat balance sheet- Characteristics curves.

**TEXT BOOKS:**


1. Ganesan, V. *Internal Combustion Engines*, 4th edition, 2015, McGraw Hill Education (India) Pvt Ltd.
2. Heywood J. B, *"Internal Combustion Engine Fundamentals"*, Indian edition, McGraw Hill Book Co. NY.


**REFERENCE BOOKS:**


1. Gilles, Tim. *Automotive service: inspection, maintenance, repair***,** 4th edition,2012, Cengage Learning.
2. Ferguson, Colin R., and Allan T. Kirkpatrick. *Internal combustion engines: applied thermoscience*, 3rd edition**,** 2015**,** John Wiley & Sons.

3. Gupta, Hari N., *Fundamentals of internal combustion engines*, 2nd edition, 2012, PHI Learning Pvt. Ltd.

**COURSE OUTCOMES:**

Student will be able to

i. Describe the operating principles of SI and CI engine
ii. Enumerate the differences between air fuel cycle and actual cycle
iii. Explain about normal combustion and abnormal combustion of IC engine
iv. Relate the effect of combustion on engine variables.
v. Select the suitable fuel supply system for both SI and CI engines
vi. Evaluate the performance characteristics and measurement of the engine
vii. Experiment to determine the performance of internal combustion engine.

**Mapping of Cos and POs**

| **A2MET309 INTERNAL COMBUSTION ENGINES** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PS02 |
| xv. | 3 | | | | | 1 | 1 | | | | | 1 | 1 | 1 |
| xvi. | 3 | | | | | | | | | | | 1 | | |
| xvii. | 3 | | | | | 2 | 3 | | | | | 2 | | |
| xviii. | 2 | | | | | 1 | 2 | | | | | 1 | | |
| xix. | 3 | 1 | | | | | | | | | | 2 | | |
| xx. | 3 | 3 | 2 | 3 | | | 2 | | | | | 1 | 1 | 1 |
| xxi. | 3 | 1 | | | | 1 | 1 | | | | | 2 | 1 | 1 |

| **A2MET309 INTERNAL COMBUSTION ENGINES** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

Signature of the Academic Coordinator Signature of the HOD

| | | L | T | P | C |
|---|---|---|---|---|---|
| **A2MET310** | **MANUFACTURING TECHNOLOGY** | 3 | - | - | 3 |
| | **Total Contact Hours – 48** | | | | |

## SYLLABUS

**UNIT-I**

**Principles of Metal Cutting:** Theory of metal cutting, Chip formation, Piispanen card model, Orthogonal and Oblique cutting, Tool designations, ASA/ORS, Conversion between systems, Types of chips, Chip control, Cutting tool materials.

**UNIT-II**

**Metal Cutting Analysis and Machine Tools:** Merchant circle analysis, Dynamometry, Wear and tool life, Cutting temperature, Cutting fluids, Machinability, Types of machine tools, Machine tool specification, Operation principles, Machine tool alignment.

**UNIT-III**

**Kinematic scheme of machines:** Speed and Feed Drive in Lathe, Speed and Feed Drive in Shaping/Planing Machine, Speed and Feed Drive in Drilling Machine, Speed and Feed Drive in Milling Machine, Other Speed and Feed Drive Configurations (Slotter, Grinding Machines etc.)

**Cutting Tools:** Single Point Tools, Two-point Tools, Multi-point Tools, Grinding Wheels (Materials and Manufacturing Methods).

**Tool Holding Systems:** Tool Post, Arbors, Collets, Chucks and Accessories.

**Work Holding Systems:** Concept of Jigs and Fixtures, Principles of Location, Locating and Clamping Methods, Work Holding Accessories on Turning, Milling, Drilling and Grinding Machines, Work Indexing Systems

**Machining Operations:** Turning (taper turning, thread cutting etc.), Hole-making (drilling, boring, reaming, tapping, slotting), Milling, Grinding and finishing operations.

**UNIT-IV**

**Mechanical and thermal energy based material removal processes:**

Need and classification of unconventional machining processes, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters, MRR, Kerf, Tool Wear, principles and process parameters of Laser Beam Machining (LBM), and Electron Beam Machining, Analysis of LBM and EBM.

**UNIT-V**

**Chemical and Electrical Energy based Material Removal Processes:**

Electro-chemical machining (ECM), Electro chemical grinding, Electro chemical honing,

Chemical machining, maskants, etchants, Electrical Discharge Machining, principle and processes parameters, Types of EDM, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Process parameters, MRR and surface finish, principle and processes parameters of Plasma Arc Machining (PAM), Types of PAM.

**TEXT BOOKS:**


1. Boothroyd.G , Fundamentals of Metals Machining and Machine Tools , CRC Press
2. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014.


**REFERENCE BOOKS:**


1. B.L.Juneja,G.S.Sekhon,Fundamentals of Metal cutting and Machine tools, Wiley Publishers,1987.
2. V.K.Jain, Advanced Machining Process, 12/e, Allied Publications, 2010
3. Roy, Choudhury,Hajra, , "Elements of Workshop Technology", Vol. II., Media Promoters


**COURSE OUTCOMES**

A student can

1. Identify different types of cutting tools and various angles associated with them. Inter conversion between different systems can also be solved.
2. Prepare process sheet for a given component to be manufactured based on capability of machine tools.
3. Understand different types of drives and mechanism to facilitate relative movements in machine tools.
4. Understand the importance of unconventional machining and their selection for a given component manufacturing.
5. Understand the working of various unconventional machining processes
6. Design and select suitable accessories for complicated work pieces.
7. Identify suitable manufacturing technique to produce a product

| **A2MET310 MANUFACTURING TECHNOLOGY** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO 1 | PS02 |
| i. | 3 | 3 | 1 | | | | | | 1 | 1 | | | | |
| ii. | 3 | 2 | | 1 | | | | | 1 | 1 | | | | |
| iii. | 3 | 3 | | 2 | | | | | 1 | 1 | | | | |
| iv. | 3 | 3 | | 2 | | | | | 1 | 1 | | | | |
| v. | 3 | 3 | 1 | 1 | | | 2 | | 1 | 1 | | 1 | | |
| vi. | | | | | | | | | | | | | | |
| vii. | | | | | | | | | | | | | | |

| A2MET310 MANUFACTURING TECHNOLOGY | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

Signature of the Academic Coordinator

Signature of the HOD

| A2MET401 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | ADVANCED STRENGTH OF MATERIALS | 3 | - | - | 3 |
| | Total Contact Hours – 48 | | | | |

## SYLLABUS

**UNIT-I Concept of Stress and Strain**

**Theories of stress and strain**: Definition of stress at a point, stress notation, stress array, normal and shear stress on an oblique plane, principal Stresses. Strain theory, principal strains, strain of a volume element, small displacement theory

**Stress-strain temperature relations**: Elastic and non Elastic response of solids, 1st law of Thermodynamics, Hooke's Law: Anisotropic elasticity, Hooke's Law: Isotropic elasticity.

**UNIT II Failure criteria and Deflection of beams**

**Failure criteria:** Modes of Failure, Failure criteria, Excessive deflections, Yield initiation, fracture, Progressive fracture.

**Deflection of beams:** Castigliano's theorem on deflections, Castigliano's theorem on deflections for linear load deflection relations, Strain energy for axial loading, Strain energy due to bending, Strain energy due to shear, Strain energy due to torsion. Deflections of statically determinate structures and indeterminate structures

**UNIT III Bending of straight beams and Curved beam theory**

**Bending of straight beams:** Review of Symmetric bending, Non symmetric bending, Bending stresses in beams subjected to Non symmetrical bending: Equations of equilibrium, geometry of deformation, stress strain relations, Neutral axis, Deflection of straight beams due to Non symmetrical bending.

**Curved beam theory:** Winkler Bach formula for circumferential stress, limitations, Radial stresses in curved beams, Stresses in crane hook and closed rings

**UNIT IV Contact stresses**

**Introduction to Contact stresses:** Introduction, problem of determining contact stresses, Assumptions on which a solution for contact stresses is based. Expressions for principal stresses, Method of computing contact stresses. Deflection of bodies in point contact

**Contact stresses for Bodies under line contact:** Stresses for two bodies in line contact: Loads normal to contact area. Stresses for two bodies in line contact: normal and tangent to contact area

**UNIT V Torsion**

**Introduction to Torsion:** Torsion of prismatic bar of circular cross section. Linear elastic solution: elliptical cross section, equilateral triangle cross section. Prandtl elastic membrane (Soap-Film) Analogy

**Torsion of Non Circular Cross Sections**: Narrow rectangular cross Section, Cross sections made up of long narrow rectangles, rectangular cross section, Hollow thin wall torsion members.

**TEXT BOOKS:**

1. Arthur P. Boresi, Advanced mechanics of materials,Wiley International, 2003.
2. B.C Punmia, Strength of materials & Theory of structures(Vol I & II), Firewall Media, 2004

**REFERENCE BOOKS:**

1. Den Hortog J.P, Advanced strength of materials, Dover publications, 2014.
2. Stephen P.Timoshenko, Theory of plates and shells, McGraw-Hill, 2010.
3. L.S Srinath, Advanced Mechanics of Solids, McGraw-Hill, 2008.

**COURSE OUTCOMES**

At the end of the course the student will be able to

1. Formulate mathematical relations for stresses and strains of members under various loading conditions
2. Understand the modes of failure.
3. Find bending stresses and deflections of beams subjected to unsymmetrical bending
4. Design curved beams
5. Determine contact stresses for members under point and line contact
6. Determine the stresses in non circular shafts subjected to torsion
7. Apply the concepts of advanced strength of materials for designing the mechanical components

| **A2MET401 ADVANCED STRENGTH OF MATERIALS** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | | | Department of Mechanical Engineering | | | | | | | | | | | |
| CO / PO/ PSO mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| xv | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 2 | 2 |
| xvi | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 2 | 1 |
| xvii | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 1 | 1 |
| xviii | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 1 | 1 |
| xix | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 1 | 2 |
| xx | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 1 | 1 |
| xxi | 3 | 3 | 3 | 2 | | | | | 1 | 1 | 1 | 2 | 2 | 2 |

| **A2MET401 ADVANCED STRENGTH OF MATERIALS** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

Signature of the Academic Coordinator Signature of the HOD

| A2MET402 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | SURFACE ENGINEERING | 3 | 0 | 0 | 3 |
| | **Total number of hours (48 hours )** | | | | |

**UNIT I**

**Introduction to Corrosion and Tribology**: Introduction to Corrosion: cost of corrosion, different forms of Corrosion: Galvanic, Intergranular, Crevice, Pitting. **(5)**

**Types of corrosion:** Erosion Corrosion, Stress corrosion cracking. Definition of Tribology, types of wear. **(4)**

**UNIT II**

**Need for Surface Engineering:** Importance and need of Surface Engineering, Classification of surface engineering processes, substrate and pretreatments. Overlay coatings: Thermal Sprayed coatings, Plasma spraying, Flame spraying **(5)**

**High Velocity Oxy Fuel coatings:** Basic mechanism of coating formation in each, Advantages and Disadvantages of each process and applications.Detonation gun spray, Plasma spray process. **(4)**

**UNIT III**

**Electrochemical coatings**: Electroplating (Cu), Electroplating (Ni), Electroplating (Cr), Electroplating (Zn) **(4**)

**Other Plating methods**: Electro-less nickel plating and anodizing, Precious metal coatings, Functional and decorative coatings: Functional and decorative electroplated coatings with Tin and Tin Alloys; Coating on plastics. **(5)**

**Diffusion coatings**: Introduction: Difference between diffusion coatings and overlay coatings; Coating medium-Coating forming elements, Basic mechanism of coating formation, Advantages and disadvantages Process fundamentals, advantages, limitations and applications of the following technologies: Carburizing – Overview of pack, liquid, and gas carburizing; **(5)**

**Nitriding** – Overview of gas and liquid nitriding; Carbonitriding and Nitrocarburising; Boronizing, Aluminized coatings, Chromized and Siliconized coatings **(4)**

**UNIT IV**

**Thin film coating technology**: Chemical vapour deposition (CVD); Physical vapour deposition (PVD); Electron beam evaporation; **(5)**

**Other coating Techniques:** Magnetron sputtering; Diamond like carbon coating technology; Thermal Barrier coatings **(4)**

**UNIT V**

**Plasma processes**: Plasma carburizing and Plasma nitriding; Plasma immersed ion implantation; Plasma enhanced physical vapour deposition**.** **(5)**

**Other plasma Techniques**: Plasma enhanced chemical vapour deposition, Note on different vacuum pumps. **(4)**

**COURSE OUTCOMES**

By the end of the course, the students should be able to:

i. Demonstrate knowledge of why the surface treatment affects the bulk properties of the material.
ii. Demonstrate a sound knowledge for the systematic application of alternative technologies used to fabricate coating systems.
iii. Analyze complex service failure problems and determine the correct surface engineering solution.
iv. Select the most suitable surface engineering techniques that would give the required properties.
v. Demonstrate knowledge of plasma assisted surface treatments.
vi. Understand the importance thin film coatings rather than claddings.

**TEXT BOOKS:**


1. Fontana "Corrosion Engineering", TMH Publishers.
2. K. G. Budinski, "Surface Engineering for Wear Resistance", Prentice Hall, New Jersey, 1998.
3. B. Bhushan, Introduction to Tribology, John &Sons, New York, 2002.


**REFERENCE BOOKS:**


1. J.R. Davis "Surface engineering for corrosion and wear resistance". ASM International®, Materials Park,
2. R.F. Bunshah, Deposition Technologies for Films and Coatings, Noyes Publications, New Jersey, 1982.
3. Surface Engineering, Process Fundamentals and Applications, Vol I &Vol II, Lecture Notes of SERC School on Surface Engineering, 2003


| **A2MET402 SURFACE ENGINEERING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Department of Mechanical Engineering | | | | | | | | | | | | |
| CO / PO mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| i | 3 | | | 2 | | 2 | | | | | | 1 |
| ii | 3 | | | 2 | | 2 | | | 1 | | | 1 |
| iii | 3 | | | 2 | | 2 | | | 1 | | | 1 |
| iv | 3 | | | 2 | | 2 | | | | | | 1 |
| v | 3 | 2 | | 2 | | 2 | 2 | | | | | 1 |
| vi | 3 | | | 2 | | 2 | 1 | | | | | 1 |

Signature of the Academic Coordinator Signature of the HOD

| **A2MET402 SURFACE ENGINEERING** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

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| A2MET403 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | AUTOMOBILE ENGINEERING | 3 | 0 | 0 | 3 |
| | **Total number of hours (48 lecture hours )** | | | | |

**UNIT I**

**Introduction :** Types of automobiles, vehicle construction and layouts, chassis, frame and body, IC engines- components, function and materials, Turbo charging- WGT, VGT and supercharging variable valve timing (VVT). Crankcase ventilation, Engine service, reboring, Decarburization, Nitriding of crankshaft.

Performance of automobiles- Taxable Power, Power and Torque Curves, Resistances to a Moving vehicle, Rolling Resistance, Wind or Air Resistance, Gradient Resistance, Total Resistance, Power required to propel a vehicle (10)

**UNIT II**

**Electrical systems**: Charging circuit, generator, Current – voltage regulator – starting system, Bendix drive mechanism, solenoid switch, Lighting systems- Headlights, Flashers, Horn, wiper, Fuel gauge – oil pressure gauge, Engine temperature indicator (7)

**UNIT III**

**Transmission systems**: clutch types & construction, manual transmission gear shift mechanisms and automatic transmission- Conventional, Automated Manual and Dual-Clutch Transmission, Continuously Variable Transmission, Infinitely Variable Transmissions, Gear ratio calculation based on vehicle gradeability & top speed, Overdrive, transfer box, flywheel, torque converter, propeller shaft, slip joints, universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive. (11)

**Steering, suspension and braking System:** Steering geometry and types of steering gear box, power steering- Hydraulic, Electro-hydraulic, Electrical, types of front axle, types of suspension systems, pneumatic and hydraulic braking systems, Antilock Braking System (ABS), Electronic Brake force Distribution (EBD) and traction control. Basic braking Calculation (6)

**UNIT IV**

**Alternative energy sources:** Ethanol Engine, Compressed Natural Gas and Natural Gas Engine, Hydrogen engine, LPG engine, engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS). (4)

**Safety systems:**

Seat belt, air bags, windshield, (2)

**UNIT V**

**Electric vehicles:** Introduction, Limitations of IC Engines as prime mover, Types of electric vehicles, components, Electric vehicle drivetrain-advantages and limitations, permanent magnet and switched reluctance motors , Electric Vehicle Power Source - Battery Capacity, State Of Charge And Discharge, Specific Energy, Specific Power, Ragone Plot, Battery Management System- SOC

Measurement, Battery Cell Balancing, Traction Batteries - Nickel Metal Hydride Battery, Li-Ion, Li-Polymer Battery. Regenerative Braking (5)

**Hybrid vehicles:** Architectures of Hybrid Electric Drivetrains-Series, parallel, series–parallel complex, advantages and limitations (2)

**TEXT BOOKS:**


1. Singh, Kirpal. ***Automobile Engineering.*** Vol. 1. and Vol. 2. Standard Publishers Distributors, 2000
2. Gilles, Tim. ***Automotive service: inspection, maintenance, repair***. Cengage Learning, 2012.


**REFERENCE BOOKS:**


1. Bhise, Vivek D. ***Ergonomics in the automotive design process***. CRC Press, 2016.
2. Xin, Qianfan. ***Diesel engine system design***. Elsevier, 2016
3. Gupta, S. K. ***A Textbook of Automobile Engineering***. S. Chand Publishing, 2014.
4. Ehsani, M., Gao, Y., Longo, S. and Ebrahimi, K., ***Modern electric, hybrid electric, and fuel cell vehicles***. CRC press, 2018.
5. Babu, MK Gajendra, and K. A. Subramanian. ***Alternative transportation fuels: utilisation in combustion engines***. CRC Press, 2017.
6. Ramadhas, Arumugam S. ***Alternative fuels for transportation.*** Taylor & Francis, 2010.
7. Erjavec, Jack. ***Hybrid, electric, and fuel-cell vehicles***. Cengage Learning, 2012.
8. Larminie, James, and John Lowry. ***Electric vehicle technology explained***. John Wiley & Sons, 2012.
9. Denton, Tom. ***Electric and hybrid vehicles***. Routledge, 2020.
10. Rajput, R. K. ***A text book of automobile engineering.*** Laxmi Publications (P) Ltd, 2019.
11. Leitman, Seth, and Bob Brant. *Build your own electric vehicle*. McGraw-Hill, Inc., 2008


**COURSE OUTCOMES:**

Student will be able to

i. Identify automobile components and select the automobiles for different applications
ii. Select the appropriate fuel supply, cooling systems and different electrical systems for a particular field of automobile
iii. Gear ratio calculation based on vehicle gradeability & top speed
iv. Identify the suitable suspension systems and design basic braking systems for different automobiles
v. Explain the significance of alternative energy sources
vi. Understand the electric and hybrid vehicles in the transportation sector
vii. Apply the acquired knowledge to select, design and evaluate the automotive vehicles for a particular application

| A2MET403 AUTOMOBILE ENGINEERING | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PS02 |
| i. | 3 | | | | | | | | | | | 2 | | |
| ii. | 3 | | | | | | | | | | | 2 | 1 | |
| iii. | 3 | 2 | 2 | 2 | | | | | | | | 2 | 1 | |
| iv. | 3 | 2 | 2 | 2 | | | | | | | | 2 | 1 | |
| v. | 3 | | | | | 2 | 3 | | | | | 2 | 1 | |
| vi. | 3 | | | | | 2 | 3 | | | | | 2 | 1 | |
| vii. | 3 | | | | | 2 | 3 | | | | | 2 | 1 | |

| A2MET403 AUTOMOBILE ENGINEERING | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
| | Ratified by: 2nd Meeting of Academic Council, 13-07-2019 |

Signature of the Academic Coordinator

Signature of the HOD

| A2MET404 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | DESIGN AND ANALYSIS OF EXPERIMENTS | 3 | 0 | 0 | 3 |
| | Total number of hours (48 lecture hours) | | | | |

**COURSE DESCRIPTION:** This course is designed for students of different fields to facilitate in learning the basics of planning, designing and conducting the experiments in order to analyze and interpret the data required. It also provides the techniques and modern tools necessary for engineering practice.

**PREREQUISITES OF THE COURSE:** Probability and statistics, Calculus

**SYLLABUS:**

**UNIT-I: Experimental Design Fundamentals**

Importance of experiments, Experimental strategies, Basic principles of design and terminology, Steps in experimentation, Guidelines for Designing Experiments, levels, treatment and interactions of design, applications.

**UNIT-II: One-factor Experimental Designs**

Randomization, completely randomized design, block design (randomized), Latin square design, statistical analysis, and estimation of model parameters. Model adequacy checking, pairwise comparison tests, Numerical examples.

**UNIT-III: Multiple factorial designs**

Factor effects and interactions, two and three factor full factorial experiments, $2^k$ factorial Experiments, confounding and blocking designs, saturated designs, central composite designs, Numerical examples.

**Special case designs**

Fractional factorial designs, nested designs, split plot designs, Response surface methodology, experiment with random factors, rules for expected mean squares, F-tests

**UNIT-IV: Analysis and interpretation methods**

Design analysis, Measures of variability, methods- column effect, ranking and plotting, ANOVA-factorial experiments and YATE's algorithm, Regression analysis - Linear and logistic, correlation, Numerical examples

**UNIT-V: Taguchi experimental design**

Steps in experimentation, orthogonal arrays- design, types and selection, robust design control and noise factors, S/N ratios – Numerical problems, parameter and tolerance design, Taguchi inner and outer arrays, and case studies.

**TEXT BOOKS:**


1. Douglas C. Montgomery, Design and Analysis of Experiments, Tenth Edition, John Wiley and sons.
2. Angela M Dean, Daniel Voss, Design and Analysis of Experiments, Springer; Corrected Edition
3. Klaus Hinkelmann, Oscar Kempthorne, Design and Analysis of Experiments: Advanced Experimental Design, Wiley-Interscience


**REFERENCE BOOKS:**


1. Krishnaiah K, and Shahabudeen P, Applied Design of Experiments and Taguchi Methods, PHI, India, 2011.
2. Phillip J. Ross, Taguchi Techniques for Quality Engineering, Tata McGraw-Hill, India

3. Aloke Dey, Theory of Block Designs, John Wiley

**COURSE OUTCOMES:**

Student will be able to

i. Describe the purpose of robust construction and how it is applied in experimental design
ii. Examine how a factorial design allows cost reduction, increases efficiency of experimentation, and reveals the essential nature of a process.
iii. Investigate the logic of hypothesis testing, including analysis of variance and the detailed analysis of experimental data.
iv. Evaluate model suitability for different engineering problems and different situations
v. Analyze experimental data with suitable software to obtain objective conclusions
vi. Apply experimental techniques to practical problems to improve quality of processes / products by optimizing the process / product parameters
vii. Formulate understanding of the subject using real examples, including experimentation in the social and economic sciences

**Mapping of Cos and POs**

| **A2MET404: DESIGN AND ANALYSIS OF EXPERIMENTS** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO/ PSO mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| i. | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 3 | 3 |
| ii. | | | | 3 | 3 | | | | | 2 | 3 | | 3 | 3 |
| iii. | | 3 | 3 | | 3 | | | | | | | 3 | 3 | 3 |
| iv. | | 3 | | | 3 | | 2 | | | | | | 3 | 3 |
| v. | | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 |
| vi | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 |
| vii | 3 | 2 | 3 | 3 | 3 | | 2 | | | | | 3 | 3 | 3 |

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| **A2MET404: DESIGN AND ANALYSIS OF EXPERIMENTS** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
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| A2MEL303 | SEMESTER –V | L | T | P | C |
|---|---|---|---|---|---|
| | Thermal Engineering lab | 0 | 0 | 3 | 2 |
| | Total number of hours (48 hours ) | | | | |

1. Measurement of Coefficient of Discharge of given Orifice and Venturi meters.
2. Determination of a major and minor loses in a pipe
3. Determination of the performance characteristics of a centrifugal pump.
4. Determination of the performance characteristics of Pelton Wheel.
5. Determination of the performance characteristics of a Francis Turbine.
6. Determination of the density & viscosity and calorific value of an oil
7. Determination of the performance of a 4-stroke petrol engine.
8. Draw Heat Balance sheet of four stroke Diesel Engine
9. Determination of the performance characteristics of a vapor compression refrigeration system
10. Determination of the thermal conductivity and specific heat of given objects.
11. Determination of the convective heat transfer coefficient for flow over a heated cylinder and flow through a pipe.
12. Determination of the emissivity of a given sample

**COURSE OUT COMES:**

Student will be able to

1. Understand the working principles of different hydraulic machines.
2. Measure the coefficient of discharge of flow meters.
3. Analyze the performance characteristics of Pump, Turbines and IC engines.
4. Conduct the experiment and determine heat transfer coefficient for flow over a heated cylinder and flow through a pipe.
5. Estimate the thermal conductivity and emissivity of the given sample.

| **A2MEL303: Thermal Engineering lab** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course designed by | Department of Mechanical Engineering | | | | | | | | | | | | | |
| CO / PO mapping | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PS02 |
| 1. | 2 | 1 | | 3 | 1 | | | | 3 | 2 | | | | 3 |
| 2. | 2 | 1 | | 3 | 1 | | | | 3 | 2 | | | | 3 |
| 3. | 2 | 1 | | 3 | 2 | | | | 3 | 2 | | | | 3 |
| 4. | 2 | 1 | | 3 | 2 | | | | 3 | 2 | | | | 3 |
| 5. | 2 | 1 | | 3 | 1 | | | | 3 | 2 | | | | 3 |

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| **A2MEL303: Thermal Engineering lab** | |
|---|---|
| Course designed by | Department of Mechanical Engineering |
| Approval | Approved by: Meeting of Board of Studies held on 29-06-2019 |
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